# PEELING BACK THE LAYERS OF TEACHER TURNOVER: AN EXPLORATION OF THE ROLE OF WORKING CONDITIONS AND TEACHER EFFECTIVENESS

by
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ABSTRACT

Teacher turnover impacts schools and students by changing the composition of teachers in a school, and by causing disruptions to the organizational functioning within schools. Research has begun to examine how the organizational conditions within schools may be implicated in this process. Efforts have also been made to determine whether more effective teachers are systematically more likely to leave than less effective teachers. To date, however, no research has simultaneously investigated the role of working and teacher effectiveness in the turnover processes within a single study. Using a sample of teachers drawn from the Measures of Effective Teaching project, and employing multi-level logistic regression analysis, this study explored several research questions relating to teacher turnover and investigated the way in which working conditions and teacher effectiveness may be interrelated in producing turnover outcomes. Findings indicated that when teachers perceived the working conditions in their schools as being more positive they were less likely to turnover. Teacher effectiveness, measured using teachers' Valued-added model scores, was not found to be statistically significantly related to turnover. Findings further indicated that in a combined model that included both working conditions and teacher effectiveness variables, inferences made about the variables were unchanged from models in which they were evaluated individually. Analysis also indicated the absence of a statistically significant interaction between working conditions and teacher effectiveness. Implications and conclusions drawn from the findings were discussed.

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# CHAPTER 1 - INTRODUCTION AND PLAN

## Introduction

Every year in the United States large numbers of teachers leave their jobs, in many cases disrupting school functioning and harming student learning. Of the approximately 3.1 million full time equivalent public school teachers in the United States, approximately 16% will no longer be teaching in the same school next year (National Center for Education Statistics, 2015). About half of the leaving teachers are expected to move to other schools, while the other half is expected to leave teaching entirely (Goldring, Taie, Riddles, & Owens, 2014; Ingersoll, 2001). For new teachers, nearly a third will no longer be teaching after three years and half are expected to leave within five years (Ingersoll, 2001).

These patterns carry academic costs for students, and considerable financial costs for schools and school districts, as students experience different educational outcomes based on the teachers to whom they are assigned (Goldhaber, Player, & Urban Institute, 2007; Rivken, Hanushek, Kain, 2005; Rockoff, 2004). When departing teachers are replaced by less effective teachers, turnover negatively impacts the quality of education (Jacob et al., 2012). Turnover can also harm instructional continuity, interfere with the development of staff relations within the school and with families, hinder efforts to build instructional practices that are reliant on institutional knowledge, and divert resources from the classroom to recruitment and training efforts (Simon and Johnson, 2015). The financial costs are also steep. Estimates for the national cost of teacher turnover range from $2.2 billion (Alliance for Excellent Education, 2014) to $7.3 billion annually (National Commission on Teaching and America's Future, 2007).

Making matters worse, turnover rates are not evenly distributed across schools. Schools with higher percentages of minority and low-SES students experience higher rates of turnover (Scafidi, Sjoquist and Stinebrickner, 2007; Hanushek, Kain, & Rivkin, 2004) and departing teachers who leave these schools but remain in teaching systematically relocate to more advantaged schools (Boyd, Lankford, Loeb & Wycoff, 2005). These trends raise concerns about social justice and equity as differential turnover patterns are a barrier to equal educational opportunity. This dissertation addresses these barriers by exploring the role of two important factors in turnover : the social and organizational conditions of schools and the quality of the teachers.

The central question in turnover research is, "Why do teachers leave their jobs?" Recent theories suggest that the feeling of being successful is a central consideration in a teachers' decision to stay in their school. (Johnson and Birkeland, 2003). These feelings of success may be shaped by both the working conditions in schools and by the quality of the teacher themselves. *Working conditions*, or the social and organizational context of the work environment, may contribute to the retention of teachers by enabling them to be successful, and *better* teachers may also be more likely to stay in their schools if better performance translates to feelings of success.

Working conditions have indeed been shown to be predictive of whether teachers will stay in their jobs (Ingersoll, 2001). Working conditions shape the teaching experience and are central to the process of translating school resources into instructional practice. When included in turnover models, these conditions also account for some of the observed turnover patterns between school-level student demographic characteristics and teacher turnover (Johnson, Kraft

& Papay, 2012; Ladd, 2011), suggesting that teachers leave high minority and low SES schools not because of the students, but because of the poor work environments commonly associated with such schools. These finding give support to the notion that working conditions facilitate teachers' feelings of success, therefore reducing the likelihood that they leave their school.

Presumably, teacher quality should also be related to their feelings of success, and would therefore factor into their decisions to stay in their school or to leave. Yet the ability to investigate the role of teacher quality in turnover has been complicated by the multiple definitions of quality that exist. Early attempts to determine the relationship between teacher quality and turnover consisted of studying the relationship between teacher *qualifications*, the on-paper measures of such things as cognitive ability, teacher certification and status, and educational background. While these measures are predicative of turnover, they are not consistently found to be predictive of student achievement (Goe, 2007; Wayne and Youngs, 2003; Wilson and Flowden, 2003), and therefore may not be related to feelings of success amongst teachers.

More recent approaches have turned to assessing the role of *teacher effectiveness*, or a teacher's independent contributions to student learning, in turnover. Turnover studies on effectiveness use Value-Added Model (VAM) scores, derived from student test score gains, to predict turnover. Studies using this approach find that, overall, the rate of attrition for more-effective teachers is not necessarily higher, and may even be lower, than the rate of turnover for less-effective teachers (Boyd, Grossman, Lankford, Loeb and Wycoff, 2005; Goldhaber, 2007; Krieg, 2006). These findings are consistent with the notion that teachers who are more successful are less likely to leave their schools. In interpreting these findings, however, consideration should be made for the absence of working conditions in both the VAMs and the turnover

models used in the studies. Because more effective teachers may sort into school with better working conditions, and because working conditions can have an impact on teacher VAM scores, the finding that more effective teachers may be more likely to stay could be spurious. The case could be that working conditions are actually driving the relationship.

Assuming that teacher quality and the workplace both act as drivers of turnover, it could also be possible that the role of organizational and contextual factors in schools operate differently for different teachers. An interactive relationship could therefore exist between teacher quality and working conditions in predicting turnover. If this is the case, certain working conditions could be strategically targeted for improvement in an effort to keep better teachers. The possibility of an interaction between working conditions and teacher effectiveness, however, has yet to be explored in the turnover literature.

This dissertation contributes to the understanding of turnover by further investigating the ways in which working conditions and teacher effectiveness are related to turnover, and by modeling how these factors simultaneously operate together in their relationship to turnover. Additionally, the potential for an interaction between effectiveness and working conditions is explored. Findings from the analysis point to measures that schools, and school districts can take to retain teachers, and improve student learning, as well as measures that researchers can take to better understand the turnover process.

The guiding research questions for the analysis were:

- *Research Question 1*: What is the role of working conditions in teacher turnover, and how do working conditions account for previously observed associations between student characteristics and turnover?

- *Research Question 2*: To what extent is teacher effectiveness related to turnover?
- *Research Question 3*: To what extent does simultaneously accounting for teacher effectiveness and working conditions change the associations between these variables and turnover, relative to when they are evaluated independently?
- *Research Question 4*: Regarding turnover, to what extent is the role of teacher quality dependent on the working conditions in a school?

## Plan of the Dissertation

Chapter 2 of the dissertation will provide a more detailed review of teacher turnover. The chapter starts with a discussion of the state of teacher turnover and its associated costs. The framework for investigating teacher turnover, based on the explanatory model proposed by Johnson and Birkeland (2003), is then described. Three main sections then comprise the remainder of the review; the first on the role of working conditions in teacher turnover, the second on the role teacher quality in turnover, and the third on the interrelationships that may exist between working conditions and teacher effectiveness in the turnover process. Chapter 3 then describes the sample, data and analytic approach that was used, Chapter 4 presents the results of the analysis, and Chapter 5 concludes the dissertation with a discussion of the implications drawn from the analysis.

# CHAPTER 2 - LITERATURE REVIEW

## The Problem of Teacher Turnover

Teacher turnover carries financial, academic, and organizational costs. Turnover occurs when teachers leave their jobs and move to different schools or leave the occupation of teaching altogether. Teachers who transfer schools but remain in teaching are often referred to as "movers", while teachers who leave the field of education are given the label of "leavers" (Kukla-Acevedo, 2009). Teachers who remain in their schools are aptly referred to as "stayers." Rates of turnover have been increasing in recent years (Ingersoll, Merrill and Stuckey 2014), suggesting that the teacher labor market is not behaving in an efficient manner. While large numbers teachers are drawn to teaching initially, suggesting that there is both a supply of and demand for teachers, substantial proportions of teachers continue to leave their schools.

These turnover patterns are potentially harmful to students. Turnover shapes the composition of the overall teacher labor force, and the composition of teachers in a given school, while also having a disruptive influence on school organizational functioning and being financially costly (Ronfelt, Loeb and Wycoff, 2013; Alliance for Excellent Education, 2014; National Commission on Teaching and America's Future, 2007).

Teachers are perhaps the most inequitably distributed school resource (Darling-Hammond, 2010, pg. 40) and turnover is a contributing factor. Low-income, low achieving, and non-White students have a higher probability of being taught by less qualified teachers, when qualification is defined by certification status, years of experience, and selectivity of undergraduate institution (Lankford, Loeb and Wyckoff, 2002; Clotfelter, Ladd, Vigdor, and Wheeler, 2007) and by teachers with lower value-added model scores (Hanushek, Kain, O'Brien and Rivkin, 2005). Turnover contributes to these patterns as departing teachers who transfer

systematically relocate to more advantaged schools, bringing with them any skills and ability that they may have developed while at their previous school (Boyd et. al, 2005).

Within schools, turnover carries both compositional and disruptive effects (Ronfelt, Loeb and Wycoff, 2013). Compositional effects are those that occur when the quality of the teaching body in a school is diminished because departing teachers are replaced by less effective teachers. Disruptive effects occur when teacher turnover impacts the overall organizational functioning of the school. Teacher turnover, for instance, can harm instructional continuity, interfere with the development of staff relations within the school and between teachers and families, hinder efforts to build instructional practices that are reliant on institutional knowledge, and divert resources from the classroom to recruitment and training efforts (Simon and Johnson, 2015).

Along with its compositional and disruptive impacts, teacher turnover also carries substantial financial costs. Drawing from an analysis of the Schools and Staffing Survey, the Alliance for Excellent Education (2014) estimates that national costs for replacing teachers who leave teaching are about $2.2 billion dollars annually. The National Commission on Teaching and America's Future (2007) estimates a higher figure, calculating that annual costs are closer to $7.3 billion annually. Despite decades of work to reduce turnover, and its associated costs, much remains to be learned about the factors that influence turnover.

## Framework for Turnover

Why do teachers leave their schools? One explanation, drawn from economic theory, posits that teachers are *rational actors* who make choices about where to work based on their own preferences and values, and on the job opportunities available to them (Strunk & Robinson, 2006). Teachers can be expected to choose the job opportunity that they find the most appealing

from all possible options, and teachers with more skills, abilities and qualifications can be expected to have a broader set of job opportunities from which to choose. The choice of where to work is based not only on salary considerations, but also on teachers' preferences for work environment factors, and the degree of satisfaction they derive from working in a school.

Based on this thinking, one expectation is that more qualified and effective teachers or teachers who exhibit the best practices in the classroom, may be more likely to turnover than other teachers because they should have a greater number of job opportunities available to them. As noted, more qualified teachers do in fact have higher turnover rates than less qualified teachers (Borman and Dowling, 2008; Guarino et al., 2006). There is an alternative possibility: that good teachers actually experience more *psychic rewards*, such as feelings of success, from teaching in their schools and therefore choose *not* to leave. This is a reasonable possibility given that teachers often enter teaching with a strong a commitment to children and a sense that teaching is part of their identity (Lortie, 2002). While aware of the low pay, limited opportunity for career advancement, and low-prestige of teaching, many teachers place more value on pursuing the psychic rewards of teaching. If they associate these psychic rewards and feelings of success with the schools they work in, they may find that staying in that school is the best option, even if other alternatives are available.

The ability to experience a feeling of success in teaching is, indeed, reported as being important to many teachers' career decisions (Johnson and Birkeland, 2003). But what contributes to teachers' feelings of success and decisions to stay? Two potentially important factors include the organizational conditions in the school, and the skills and abilities of teachers themselves. Based on interviews with 50 first and second-year Massachusetts teachers, Johnson and Birkeland (2003) find that the organizational conditions, or *working conditions*, of schools

are a determining factor in teachers' turnover decisions, because teachers believe these conditions contribute to their ability to teach well. These working conditions include such things as curricular materials available, relationships with administrators and colleagues, and the extent of the assignments and workload given to teachers. *Teacher quality,* the set of teacher attributes and practices that contribute to student learning, may also factor into to a teacher's feelings of success. One component of teacher quality in particular may be especially important to this process: *teacher effectiveness*. Teacher effectiveness represents the independent contribution that teachers make to student learning, or the contribution that teachers make to student learning after accounting for school characteristics and student background. Effectiveness may be negatively associated with turnover because teachers who contribute to student learning through their independent skills and efforts may recognize that they are having an impact and derive satisfaction from that success, resulting in lower rates of turnover for those teachers.

While both working conditions and teacher quality may therefore act as drivers of teachers' turnover decisions, identifying the independent role that they each have on turnover, or the causal association that they have with turnover, is complicated by a number of factors. School characteristics, student characteristics, and teacher characteristics are comingled within schools and have complex interactional relationships. Consider the Cohen (2003) model of *instruction as interaction* in Figure 1.

The model depicts the interrelationships between different components of the instructional process, emphasizing that "teaching" is what teachers do with students, concerning content, in particular environments. These components are not independent, but rather are interrelated in the way that they contribute to student outcomes, and ultimately teacher turnover decisions. As students and teachers are inequitably distributed across schools with different working conditions, it is difficult to isolate the role that each factor plays in turnover if the other factors are not also accounted for.

Fortunately, in recent years teacher turnover research has seen a steady growth in the sets of school, student, and teacher characteristics that have been included in analytical models of turnover. Both working conditions and teacher quality measures have been used to predict whether teachers will leave their schools. Up to now, however, working conditions and measures of *teacher effectiveness* have not both been simultaneously included in these predictive models. Given the set of interrelationships that these variables share, this shortcoming presents a challenge to correctly identifying the associations that working conditions and teacher effectiveness independently have with turnover. Figure 2 presents a conceptual model that draws these variables together and focuses on the ways in which they may operate as drivers of teacher turnover decisions.

As noted, both teacher effectiveness and working conditions may be directly related to turnover. There is a common belief that for *good teachers* to be successful they must work in schools that are organized for success (Johnson and Birkeland 2003; Morgan and Shakelford, 2016; Darling-Hammond, 2010). Implicit in this belief is the notion that there is

such a thing a good teacher, an *effective* teacher, a teacher with skills and abilities that are independent of the school itself. *Measures* of teacher effectiveness, in the form of Value-Added Model (VAM) scores, however, vary in the extent to which they account for school characteristics, and very often do not include the social and organizational working conditions of schools. School working conditions may therefore factor into calculated VAM scores, and biased interpretations made about the role of teacher effectiveness in turnover. This relationship is shown with the dotted arrow. Effective teachers may also sort into schools with better working conditions, complicating interpretations about how these variables are each independently associated with turnover.

While it may be true that working conditions influence turnover decisions through their relationship with teachers' feelings of success, teachers may also choose to stay in schools with better conditions simply because they prefer these schools over alternative options. Such preferences could explain the observed association between student demographic characteristics, which are correlated with working conditions, and teacher turnover. The following sections describe these relationships more fully by offering a review the current literature on working conditions, teacher quality, and turnover.

## Working Conditions and Teacher Turnover

Research on the role of working conditions in teacher turnover emerged partially in response to concerns that student demographic characteristics have been consistently found to be some of the strongest predictors of teacher turnover. Teachers in schools with higher percentages of minority students and low-income students are more likely to leave their jobs than teachers in other schools (Hanushek, Kain, & Rivkin 2004; Boyd et al., 2005; Scafidi et al., 2007) and often

relocate to schools serving whiter and more advantaged student populations (Lankford, Loeb, & Wyckoff, 2002; Boyd, Grossman, Lankford, Loeb, & Wycoff, 2008). Teachers are also more likely to leave schools with higher proportions of low performing students (Guarino et al., 2006; Hanushek, Kain, & Rivkin, 2004), though this may only be the case for highly qualified teachers (Boyd, Lankford, Loeb, & Wyckoff, 2005).

One possible explanation for these patterns is that teachers are leaving high-minority, low income, and low performing schools because of the students themselves. These teachers may feel that they are better able to meet the needs of whiter, richer, higher achieving students (Ladd, 2011), or they believe that such students would be easier to teach. An alternative explanation is that teachers are choosing to leave the poor working environments that are commonly associated with schools serving, poor, minority, and underperforming students (Johnson et al., 2012). For instance, Hanushek et al. (2004) suggest that student minority status possibly predicts turnover because schools with higher minority concentrations may also have higher levels of "discipline problems, rigid bureaucracies, poor leadership, high student turnover, and general safety concerns" (pg. 351). Along with other elements of the school environment, these school characteristics are commonly referred to as *working conditions* or workplace conditions.

Working conditions include the physical, organizational, sociological, political, psychological, and educational features of the work environment (Ladd, 2011; Johnson et al. 2005). They are the "organizational characteristics and conditions of schools" (Ingersoll, 2001, pg. 499) and the "conditions in which teachers work" (Johnson et al., 2005, pg. 4). Working conditions function as the connective tissue between resources and instruction, and they are increasingly being linked to a number of educational outcomes. In schools where teachers perceive the workplace as being more positive, students achieve at higher levels, even when

controlling for student demographic factors (e.g. Johnson et al., 2012; Kraft, Marinell and Shen-Wei Yee, 2016). Studying schools in Chicago, Bryk et al. (2010) find that school leadership, parent-community ties, professional capacity, a student-centered learning climate, and instructional guidance in particular are predictive of student achievement, and Darling-Hammond (2010) argues that, "all else being equal, schools have higher levels of achievement when they create smaller, more personalized units in which teachers plan and work together around shared groups of students and common curriculum" (pg. 239). These findings point to the importance of working conditions in student learning but working conditions can also shape school functioning through their relationship with teacher turnover.

Working conditions are likely related to teacher turnover through several mechanisms. One possibility is that achieving success with their students is a central consideration in a teacher's decision to stay in their school (Johnson and Birkeland, 2003), and that when schools are organized to support and enable effective instruction, teachers may experience a greater sense of self-efficacy, and satisfaction, resulting in a lower turnover rate. Working conditions may also be related to turnover decisions in other ways. Teachers, for instance, may be more likely to remain in environments where they experience a sense of belonging, feel they have a voice, where they feel safe and secure, and where they feel a sense of support from the school and from the broader community. These factors may all be related to a teacher's sense of emotional well-being, and their overall satisfaction with the work that they do.

Different working conditions ultimately contribute to these processes in different ways. The most frequently investigated working conditions in the turnover literature include school leadership, teacher leadership and autonomy, collegiality, time and workload, facilities and

resources, community support and involvement, student behavior and conduct management, and professional development.

School leadership has consistently been found to be negatively associated with turnover, and a number of explanations have been suggested to explain these findings. School leaders support teachers directly, by providing instructional guidance and feedback on teaching, and indirectly, by creating the environments that support effective teaching (Grissom, 2011). They accomplish these goals by helping to define the school mission, building organizational capacity for innovation, and by influencing other aspects of the organizations (Ladd, 2011). Leaders, for example, are important in facilitating teacher empowerment, fostering teacher collaboration, helping teachers maintain discipline in their classrooms, and providing opportunities for collaboration and professional development (Ladd, 2011). They can also work to ensure that teachers have appropriate instructional materials (Grissom, 2011) and are insulated from district office mandates (Boyd et al. 2011).

Given the broad scope of influence that school leaders have in shaping school environments, school leadership is often found to be a stronger predictor of turnover than other working conditions (Ladd, 2011; Boyd et al., 2011). When asked directly about what factors matter most in making their decision to stay in or leave their school, teachers cite school leadership as being the most important factor (Boyd et al, 2011). The role of leadership is even stronger in schools serving poor and minority students than in other schools. This may be because in more advantaged schools there are other factors that buffer against teachers becoming dissatisfied in their work, but in poor and minority schools an effective principal may be a prominent source of support for teachers (Grissom, 2011). Importantly, the relationship between school leadership and turnover does not appear to solely operate through school leaders'

influence on other working conditions. Even when accounting for teacher influence, staff relations, level of student problems in the school, school safety, and the physical environment of the school, teacher perceptions of school leadership is still found to be a buffer against turnover (Boyd et al., 2011).

The ways in which teachers take leaderships roles, and the amount of autonomy they have in decision making, are also important to teacher turnover decisions (Ingersoll, 2001; Allensworth, 2009; Yesil Dagli, 2012). When teachers have more opportunities to determine school policy, make decisions about what happens in their classrooms, select curricular texts and content, and shape school discipline practices (Weiss, 1999), they are less likely to leave. Teachers in schools with higher levels of teacher leadership may feel that they have more control over their practice, may experience lower levels of stress, and higher levels of satisfaction in teaching (Kukla-Acevedo, 2009). Taking on too much leadership responsibility, however, can have negative consequences, as these responsibilities may distract from teaching. This may explain why in some cases teacher autonomy has *not* been found to be significantly related to turnover (Djonko-Moore, 2015; Kukla-Acevedo, 2009), and may at times even be *positively* associated with turnover (Boyd et al., 2011). Additionally, having influence in what happens in the school may not be as important to teachers as the type of influence they have. For instance, having control over social issues, like discipline policy, is more strongly related to the likelihood that a teacher stays in their school than having control over instructional issues, like setting grading standards or selecting course texts (Ingersoll, 2003).

Having manageable demands on *time and workload* may also be an important consideration in teachers' appraisal of their working experience. Johnson (2012) finds that teachers who feel that they have more time are less likely to intend to turnover. *Time,* in this

research work, reflects teachers' perceptions that there is enough time to meet the needs of their students, that they have enough time to meet and plan with their colleagues, and that they are protected from administrative duties (Ladd, 2011); in other words, teachers' perceptions that they have sufficient time to meet the instructional and non-instructional responsibilities in their school (Johnson et al., 2012). A related working condition is a teacher's perception that they have an unmanageable *workload,* or have too much to do with too little time to do it. This may lead to burnout and subsequently higher levels of turnover. Torres (2016) finds, for example, that for a sample of teachers working in a charter management organization, having a manageable workload is negatively associated with turnover. In other instances, however, time and workload have not been found to be related to turnover (Ladd, 2011; Pogodinski, Youngs, Frank, and Belman 2012), suggesting that other working conditions may be more important to turnover decisions.

The social environments of schools, for instance, are also important to teachers, and higher levels of teacher *collegiality* are found to be negatively associated with teacher turnover (Johnson et al. 2012, Marinell and Coca, 2013; Kraft et al, 2016). One possible explanation for this finding is that when teachers do not get along with their co-workers, feel that their co-workers do not put in the same level of effort and are unsupportive, they may become demoralized and, therefore, delivering effective instruction may become more difficult. Schools with higher levels of collegiality, may also have more stable visions for teacher responsibilities, and may place a greater emphasis on team teaching and resource sharing, all factors which might contribute to teachers' decisions to stay in their schools.

Because many teachers enter teaching out of a desire to make a difference in the lives of children, *student conduct management* is another social factor in the school that may be

especially important to teachers' decisions to continue teaching. When student conduct interferes with instruction, or when teachers feel unsafe because of the level of misbehavior in their schools, their sense of efficacy, morale and overall satisfaction may be reduced, resulting in greater levels of turnover (Weiss, 1999; Hughes, 2012). Not surprisingly, teacher perceptions of student behavior problems have consistently been linked to turnover (Weiss, 1999; Ingersoll, 2001; Stuit and Smith, 2012; Djonko-Moore, 2016).

Given that teachers may be more likely to stay in schools where they are being supported and given opportunities to be successful, we might expect that the quality of *professional development* opportunities and induction and mentoring programs would also be related to turnover. These opportunities and programs might allow teachers to continue to develop their instructional capacity. A consistent link between teachers' perception of professional development and turnover, however, has yet to be established (Ladd, 2011; Torres, 2014). This may be because, despite their intentions, professional development programs are not currently effective in improving teacher practice, teacher self-efficacy, or feelings of success (Ladd, 2011). Participation in induction and mentoring programs, on the other hand, is found to be negatively associated with turnover (Smith and Ingersoll, 2004; Redding and Smith, 2016), perhaps because such activities are more directly related to efficacy and morale for new teachers.

Aspects of c*ommunity support and involvement,* or "the extent to which families and the broader community support teachers and students in the school" (Johnson et al., 2012, pg. 13), may be related to turnover for similar reasons. When teachers feel that they are supported not just by school staff members but by members of the broader community, they may feel that they have more opportunities to be successful. When asked, for example, about why teachers consider changing schools, the amount of support that students get with their work at home is commonly

cited as an important factor (Elfers, Plecki, and Knapp, 2006). While teacher perceptions of community support are found to be correlated with their career intentions, (Johnson et al., 2012), this relationship may diminish when other working conditions, which may be more important to teachers, are accounted for (Hughes, 2012).

Along with the social and instructional conditions of schooling, the physical environment is also important. When teachers feel that the f*acilities and resources*, in their schools are appropriate, well maintained and supportive, teachers may be more likely to stay in their schools. Conversely, Ladd (2011) postulates that when teachers feel unsafe and unsupported in their work environments because of poor facilities and limited and inappropriate resources, teachers will be more likely to turnover. The findings on the role of facilities and resources, however, have been mixed. Pogodinski et al. (2012) found that the availability of teaching materials was related to novice teachers' intention to remain in their school. Boyd et al. (2011), however, found that teacher's perceptions of their schools' facilities were negatively associated with turnover only when other working conditions were not accounted for. When these other variables were accounted for, the relationship lost statistical significance. Other researchers similarly found that when facilities and resources were assessed in statistical models that accounted for other variables, no relationship was found between the facilities and resources and turnover (Ladd, 2011; Redding and Smith, 2016; Hughes, 2012).

The role of working conditions in the turnover process is dynamic, with differences being observed across contexts and populations. Their influence may change based on the level of the conditions within a school (Kraft et al., 2016) and based on the student composition of the school (Grissom, 2011). This is to say, that for schools with poorer organizational conditions, and for schools that are "hard to staff", improving working conditions have differential effects than they

do in other schools. The role of working conditions function differently for teachers who leave their school and move to another school compared to teachers who leave teaching all together (Kukla-Acevedo, 2009). There may therefore be concrete differences between teachers who are simply mismatched with their schools, and teachers who are mismatched with the occupation overall in terms of how school factors influence their behavior.

Overall, working conditions are important factors in teacher turnover decisions, shaping the ways in which teachers experience their schools, and potentially enabling teachers to deliver effective instruction (Johnson and Birkeland, 2003). Working conditions have even been able to partially explain the higher rates of turnover at schools serving poor and minority students, as once they are accounted for the relationship between student characteristics and turnover diminishes (Boyd et al, 2011; Johnson et al., 2012; Ladd, 2011). School leadership in particular may be especially important in this regard, as perceptions of leadership quality have been shown to be more predictive of turnover than student body characteristics (Boyd et al., 2011). Yet exactly which working conditions matter the most for teacher turnover decisions has yet to be fully established. Similarly, the full extent to which working conditions account for the higher rates of turnover in schools serving poor and minority students, and in which contexts, is still being clarified. Additional research on these topics will help provide a clearer picture of the turnover process. Given the possibility that working conditions may operate through their ability to generate feelings of success in teachers, other factors that may lead to success should also be accounted for in the turnover research on working conditions. The quality of the teacher, and teacher effectiveness in particular, may be especially important to consider.

## Teacher Quality and Teacher Turnover

### Defining Teacher Quality

Not all teacher turnover is necessarily bad, and schools may actually benefit when ineffective teachers leave. Susan Moore Johnson (2005) argues that when retention efforts result in schools and districts keeping teachers who are "incompetent, mediocre, disengaged, or burnt out" (pg. 2) student learning suffers. Efforts to reduce turnover should therefore focus on those teachers who are "skilled and effective in the classroom, are committed to student learning, and are ready and able to contribute to the improvement of their school." Teachers of higher *quality* would then be more likely to be retained, and teachers of lower *quality* would be filtered out. While the desire to keep better teachers in schools, with the hopes of improving learning outcomes for students, is sensible and legitimate, doing so is complicated by a number of factors. Johnson's argument, for instance, assumes that quality is an identifiable and measureable characteristic of a teacher, that quality is determinant of student outcomes, and that retention efforts are capable of targeting teachers based on quality. Yet defining and measuring teacher quality, and determining the role that it plays in student learning and teacher turnover is not simple.

Researchers, parents, and even teachers disagree about what teacher quality is, the attributes that quality teachers possess, and what quality teaching looks like. Consider an example demonstrating just one of the differences in thinking about how to define teacher quality. Hanushek (2002) states that: "good teachers are ones who get large gains in student achievement for their classes; bad teachers are just the opposite." (pg. 3). By this definition, in which student achievement is reflected by standardized test score growth, teacher quality is reduced down to a single measurable outcome. The process by which teachers *get large gains*,

however, and the impact that teachers have on unmeasured student outcomes, are not reflected in the definition. This contrasts directly with the more expansive conceptualization of teacher quality offered by Gloria Ladson-Bilings (Au & Ladson-Bilings, 2005) who has suggested that while teacher quality cannot be divorced from student learning, student learning is *not* reflected in standardized test scores. Quality teaching, she argues, cannot be identified with a single on-paper attribute or measure of a teacher. Where Hanushek defines student learning and teacher quality in direct, concise, observable terms, Ladson-Billings believes the opposite and maintains that they cannot be defined in such simple terms.

The difficulty in developing a consistent, universally agreed upon definition for teacher quality is attributable to different stakeholders having different priorities for what happens in the classroom. Since its earliest days the American education system has serviced not only students, but also parents, politicians and government entities, the business community, and other interest groups (Tyack, 1974). The education system has taken on multiple, sometimes conflicting, responsibilities and places the onus on teachers to fulfill them (Kirst, 1984). Teachers have been held responsible for such tasks as imparting basic knowledge in core academic areas, encouraging moral, social, and civic development, and fostering creativity. This has resulted in a diverse set of conceptualizations about what teaching is and what quality teaching looks like. Teaching, for instance, has been conceptualized as: *labor*, in which effective teachers make the best decisions about how to translate school resources into student learning; a *profession*, in which effective teachers draw on a strong knowledge base to produce student learning; a *craft*, in which effective teachers interact with and meet the needs of their individual students; and an *art,* in which effective teachers have a "special gift" for working with students, but also attend to the pedagogical implications of their surrounding contexts. (Harris and Rutledge, 2010).

Despite the diversity in conceptualizations of teacher quality, the set of characteristics, behaviors, and outcomes that are implied when the term *teacher quality* is used ultimately constitutes a finite set of constructs. While researchers disagree about specific definitions, or focus on different constructs when they discuss quality, there are a few consistent elements that comprise the discourse. Research on teacher quality generally consists of at least one of the following elements: the attributes and characteristics of teachers, teacher practice or what teachers do in the classroom, and teacher contributions to student learning. These elements are not independent of one another, but rather have the potential to be influenced by one another.

I propose a definition of teacher quality that reflects each of these elements: *Teacher quality is the set of teacher attributes and practices that contribute to student learning*. In this view teacher quality is not a single specific characteristic of a teacher, but reflects more the set of relationships between teachers, the environments in which they work, the students they work with, the instruction they deliver, and the outcomes they produce. As such, while relationships between *teacher quality* and turnover would be difficult to observe, in part because there is not yet a single variable or measure representing the construct, exploring the relationships between the constituent components of teacher quality is more easily accomplished. Here I briefly describe each of the elements of my definition of teacher quality, and then provide a review of the literature on their relationship to turnover.

*Teacher Attributes* are the characteristics of individual teachers themselves. They are the product of genetic and environmental factors and include such things as educational background and on-paper qualifications (e.g. certification type, Praxis exam scores), cognitive ability, attitudes,

beliefs, values, and dispositions. Attributes such as educational background, years of experience, training and certification, are more readily observable than constructs such as attitudes values and dispositions. Often included under the label *teacher qualifications* they have received more attention in the research literature than less consistently observed measures like attitudes and beliefs.

*Teacher Practice* is defined by the behaviors that teachers exhibit during in-class instruction and within the broader school community. These behaviors are shaped by the teachers' attributes and, in turn, shape student outcomes. They relate directly to and are informed by the environments in which teachers teach (including the working conditions of schools) and by the students that teachers work with. They include instructional practice and decision making that reflects the views, needs, and wishes of the school and students; utilization of school human, financial, and social resources to improve instruction; and interactions with students, teachers, parents and other members of the community. Often, teacher practice that is believed to be good or appropriate for the context in which it occurs is referred to as *quality teaching*.

*Teacher-Specific Contributions to Student Outcomes* are the changes in student knowledge, understanding, and personal and interpersonal growth that can be attributed to the individual teacher working with those students. They include contributions to academic achievement, socio-emotional development, and student welfare. Rather than being wholly independent of teacher attributes and teacher practice, these elements may partially influence the contributions of the individual teacher. Teacher-specific contributions, however, are conceptually distinct from the

contributions to learning that arise from the students' backgrounds, other teachers, or the features of the school they attend.

The sorting of students and teachers across and within schools makes the teacher-specific contributions challenging to identify. When gains in student outcomes are measured, it is difficult to distill the extent to which the teacher is responsible for the gains, and to distinguish the contribution of the teacher to that of the students' background or of the school. Of the student outcomes that teachers contribute to, student achievement, in the form of standardized test score growth, has received the most policy and research attention. Measures of these contributions are often referred to as measures of *teacher effectiveness.*

Teacher effectiveness, in this sense, is distinguishable from broader definitions of teacher quality in that it relates only to student learning that can be measured by test scores. To the extent that test scores measure valued aspects of student learning, retaining *effective* teachers is a desirable goal. Teacher effectiveness is measured using Value-Added Model (VAM) scores. VAMs are unique amongst approaches that use standardized test data in that they attempt to isolate the effects of teachers from the influence of other factors that may contribute to student learning. This is accomplished by accounting for these other factors, or controlling for these other factors, in the models. Under certain conditions, such as when all other factors beyond the impact of the teacher as successfully accounted for, the effects calculated by VAMs can, in theory, be considered causal effects. Importantly, because VAMs may not always successfully control for the full set of school factors that contribute to student learning, teacher VAM scores may partially reflect the influence of these factors. In such a case, the *measure of teacher effectiveness*, the VAM score, would not reflect a clean estimate of teachers' actual effectiveness.

Knowledge about the ways in which the components of teacher quality are related, and the ways in which they determine teacher turnover are beginning to emerge in the research literature. Three trends, in particular, stand out: 1) teacher attributes traditionally believed to be associated with student learning outcomes, such as level of education or cognitive ability, are generally *not* predictive of teacher effectiveness; 2) these teacher attributes *are* found to be predictive of teacher turnover; 3) teacher effectiveness is generally not found to be associated with teacher turnover, though in some cases more effective teachers may be *more* likely to remain in their schools. Despite the identification of these trends, the reasons for why these patterns exist is largely under theorized.

Surprisingly little research has been conducted on the relationship between teacher practice and turnover, though it would be reasonable to believe that differences in teacher practices would be differentially predictive of turnover. Feelings of being successful in teaching, for instance, may not only emanate from teachers' contributions to student test scores, but also from the experience of teaching itself. Different *teacher practices* could also be reflective of teacher attributes that are not commonly measured, but may be related to turnover. These could include such attributes as socio-emotional competence (Jennings and Greenberg, 2009), and other forms of intelligence that relate to an individual's capacity for conducting "emotional labor" (Hochschild, 2003). While teacher practice and *quality teaching*, are important components of teacher quality, the remainder of this review focuses on the components of quality that have been more fully researched in their relationship to turnover. Similarly, as student achievement is the primary student learning outcome investigated in the turnover

research, the review focuses specifically on aspects of quality believed to be related to achievement.

## Teacher Attributes, Student Achievement, and Teacher Turnover

### *Teacher Attributes and Student Achievement*

Teacher attributes may have a direct bearing on teacher performance and student outcomes and teachers are commonly believed to be the most important in-school factor in student learning outcomes (Rivken, Hanushek, Kain, 2005). As such, efforts have been made to identify those teacher attributes which are most directly related to student learning. This research has largely focused on the association between teachers and student achievement gains reflected by standardized test score growth. While other socio-emotional and developmental outcomes are important for student growth, a lack of data collection on these outcomes has contributed to a limited understanding of how teacher attributes may contribute to them.

Teaching experience is the teacher attribute that is most consistently found to have a positive association with student performance (Rice, 2003; Wilson and Floden, 2003), though this may only hold true in the first five years of teaching (Goe, 2007). Why experience matters for effectiveness is not clear, as experience is difficult to disentangle from school effects. The role of experience on student learning may operate through the conditions within schools, with teachers in schools with better working conditions benefiting more from the experience of teaching than teachers in other schools.

A teacher's ability to draw from a developed body of knowledge about teaching, and about how to best serve the needs of the particular students that the teacher is assigned to, could reasonably be expected to improve the learning outcomes of students. Despite this, teacher educational background, such as concentration and level of degree completed, is not consistently

found to be a strong predictor of student achievement (Wilson and Floden, 2003). Similarly, no consistent patterns have been found linking teacher certification type to student learning (Wilson and Floden 2003). There is some evidence, however, that teacher coursework in pedagogy and especially in content pedagogy may have an impact (Rice, 2003), particularly for math teachers (Wayne and Youngs, 2003; Wilson and Floden, 2003; Goe, 2007). While teacher intelligence and cognitive ability may be expected to have a bearing on student outcomes, measures of verbal ability, college entrance exam scores, and college selectivity, are not strongly linked to student achievement (Goe, 2007; Wayne and Youngs, 2003; Wilson and Flowden, 2003).

Generally, teacher demographic characteristics do not appear to be determinant of student outcomes, as teacher race, ethnicity and gender are largely not predictive of student achievement (Goe, 2007). Other teacher attributes, like teacher personality, beliefs about students, and emotional intelligence, may be more important for student learning, though they have not been deeply researched (Harris and Routledge, 2010). Overall, these findings suggest that while attracting the *best and brightest* to teaching may be important to the goal of equal educational opportunity for students, the determination of who the *brightest* are may be in need of rethinking.

*Teacher Attributes and Teacher Turnover*

Given concerns about the potentially negative consequences of teacher turnover, considerable efforts have been made to identify which teachers may be more likely to leave based on their observable attributes. Overall the relationship between teacher attributes and turnover appears to be consistent with a rational actor model in which individuals seek out opportunities that they expect will be the most rewarding. In this model, individuals with more demonstrable skills or qualifications have a broader set of employment opportunities and may be

more likely to switch jobs or occupations. More *qualified* teachers should therefore be more likely to leave their jobs. Supporting this notion, teachers with more advanced degrees are more likely to leave the teaching occupation than teachers with bachelor's degrees (Johnson, 2005; Borman and Dowling 2008). Having a science or math undergraduate degree, relative to other undergraduate degrees, is also associated with a higher probability of turnover. Similarly, teachers from more highly selective colleges, and teachers with higher CTBS and ACT exam scores are more likely to turnover than other teachers (Guarino et al., 2006).

Assuming that there is a demand for individuals with math and science degrees in fields outside of teaching, and assuming that teachers of those subject areas are more likely to hold such degrees, we might expect greater turnover for teachers in these fields relative to other fields. There is mixed evidence that this pattern occurs. Secondary teachers, particularly science teachers and sometimes math teachers, are more likely to leave than are elementary teachers (Guarino et al. 2006; Borman and Dowling, 2008). Amongst secondary teachers, however, math and science teachers may have lower probabilities of attrition than teachers of other subject areas (Borman and Dowling, 2008).

New teachers may be especially sensitive to the potential benefits offered by other positions or occupations. Teachers in their first years may find that teaching in a particular school, or teaching overall, may not be a good fit for them, whereas teachers with more experience may be more likely to have made a decision to stay in their jobs earlier in their career. It may also be difficult for new teachers to feel that they are being successful, as teachers with less experience are not as effective as their more experienced peers. There is evidence of a U-shaped trend for length of teaching experience in predicting turnover, indicating that the least experienced, along with the most experienced teachers, leaving at higher rates than other

teachers (Johnson et al., 2005; and Guarino et al., 2006). Retirement decisions likely explain the higher rates of turnover for teachers with the most experience.

Expansions in student populations, and increasing rates of teacher turnover, along with attempts to increase the supply of teachers, have led to a proliferation in teacher certification pathways, which are in turn related to turnover patterns. Certified teachers are more likely to be retained than non-certified teachers (Borman and Dowling, 2008), and alternatively certified teachers are more likely to turnover than other teachers (Redding and Smith, 2016). Apparently contrasting with a rational actor model, these patterns may partially be explained by different orientations towards teaching amongst traditionally and non-traditionally certified teachers. People who develop an identity of "self-as-teacher," or who are in other ways more committed to the occupation of teaching, may be more likely to enter into teaching through traditional pathways, and may also be more likely to stay in teaching.

Along with teacher qualifications, teacher demographic characteristics also appear to have some relationship to turnover. Non-White teachers have lower turnover rates than White teachers (Guarino et al., 2006) and women have higher attrition rates than men (Guarino et al, 2006; Borman and Dowling 2008). In terms of age, the youngest and oldest teachers appear to be more likely to leave than those in the middle (Borman and Dowling, 2008; Guarino et al, 2006; Ingersoll, Merill, and Stukey, 2014). These trends are concerning, as the share of female teachers, and the share of teachers who are older has been growing in recent years (Ingersoll, Merill, and Stukey, 2014). Understanding the changes that schools can make to retain these teachers will be important to the goals of stabilizing turnover rates.

Overall, the relationship between teacher attributes and turnover fits a rational actor model, with more *qualified* teachers turning over at higher rates. Given the inconsistency in

linking these attributes to student achievement, however, these attributes may be related to turnover through mechanisms that are independent of teachers' contributions to student learning, and potentially independent of their feelings of being successful. The remainder of this review therefore focuses on the relationship between teacher effectiveness and turnover, accounting for the ways in which effectiveness, defined by teachers' individual contributions to student test score gain, and working conditions may be interrelated.

**Teacher Effectiveness and Turnover**

The finding that turnover rates are higher for teachers with more advanced degrees, from more highly selective colleges, and with higher college entrance exam scores, may suggest that the most capable teachers are harder to retain. Yet concerning student achievement, a consistent link between these teacher attributes and student learning has yet to be established. This has promoted researchers to investigate whether more *effective* teachers are also more likely to turnover. In contrast to the findings on teacher qualifications, the rate of attrition for more-effective teachers is *not* necessarily higher, and may even be lower in some contexts, than the rate of turnover for less-effective teachers (Boyd et. al, 2008; Goldhaber, 2007; Hanushek et al., 2005; Krieg, 2006). This finding is in apparent contradiction with the rational actor theory explaining why more highly *qualified* teachers are more likely to turnover. Presumably, more effective teachers would have a greater number of alternative options available to them, and as with more highly qualified teachers, they would be more likely to turnover. But this is not the case.

One explanation for this could be drawn from the finding that feelings of success are central in teachers' decisions to stay in their jobs (Johnson and Birkeland, 2003). If teachers who

are more "effective" also sense or experience that they are being successful, then these teachers would not be expected to have higher rates of turnover than other teachers. Krieg (2006) also offers several other explanations. One possibility is that teachers who enter teaching out of a strong desire to be a teacher, or out of self-identifying as a teacher, may be more effective than teachers who enter teaching for other reasons. These teachers would also be more likely to remain in teaching. He also suggests that along with the *intangible benefits*, such as personal satisfaction or enjoyment derived from effective teaching, teachers who are more effective may also have a greater expectation to be rewarded in other ways. These teachers, for instance, may receive preferential treatment from the administration, potentially in the form of being able to select students, professional development opportunities, or being considered for advancement. Additionally, the skills associated with effective teaching may not be highly valued in other occupations, meaning that effective teachers would not be more likely to leave the occupation because they have a broader set of opportunities than other teachers.

While these explanations provide some reasoning for why more effective teachers might have lower turnover rates, and while more effective teachers have been found to be less likely to turnover in *some* contexts, the research base has not yet provided sufficient evidence that more effective teachers are *systematically* less likely to turnover. Concluding that current patterns of turnover may actually be beneficial to schools would be premature. Consideration needs to be made for the mixed nature of the results and their limited generalizability, and for the measure of teacher effectiveness used and the way in which it may not account for the role of working conditions.

The finding that more effective teachers are less likely to turnover is not consistent across all teacher groups. In one study more effective female teachers were more

likely to stay, but the trend did not apply to male teachers (Krieg, 2006). In another study, more effective first-year teachers were more likely to be retained, while effectiveness did not play a role for more experienced teachers (Boyd et. al, 2008). More research needs to be conducted, therefore, before consistent claims can be made about the role of teacher effectiveness in turnover. Overall, even if more effective teachers are truly not more likely to turnover than less effective teachers, this finding does little to alleviate concerns that schools are still losing effective teachers at rates that have a negative impact on student learning.

## Linking Working Conditions, Teacher Effectiveness, and Turnover

According to Johnson and Birkeland (2003), positive working conditions are associated with lower levels of turnover because better environments enable teachers to be successful, and the feeling of being successful is an important factor in teachers' decisions to stay in their schools. Making a similar claim, Darling-Hammond (2010) writes, "For teachers to be highly effective, they need to work in schools that are organized for success—schools that enable them to know and reach their students, teach them to worthwhile learning goals, use productive tools and materials, and continually improve their practice." (pg. 234). But effective teachers may also be successful regardless of the conditions in their schools. If effectiveness and working conditions are related, and both have been observed to predict turnover, is it possible that accounting for both variables simultaneously changes the nature of the observed relationship?

To answer this question, measures of both teacher effectiveness and school working conditions need to be accounted for at the same time in teacher turnover research. This has yet to happen. Current studies on effectiveness and turnover employ a two-stage process in which a

regression model is run to determine a teacher's value-added score in the first stage, and then that score is used in a regression model predicting turnover in the second stage. Working conditions, however, are not included in either stage.

As noted earlier, teacher value-added models (VAMs) are statistical models that attempt to identify the relative effects that teachers have on student learning (Harris, 2011). To do this successfully these models must account for all the factors that may contribute to the test score gains of an individual teacher's student, including the school's workings conditions. Unfortunately, the VAMs used in teacher turnover research do not account for working conditions. The VAM scores calculated may therefore not present a clean estimate of the contribution of the teacher to their students' learning, but may instead partially reflect the contributions of the school environment along with the contribution of the teacher.

One approach that has been used to account for school factors is to include a school fixed effect in the value-added model. For instance Boyd et al., (2008) include a school fixed effect in their VAM, resulting in a teacher effectiveness score that is relative to the other teachers *in the same school*. This creates difficulty in comparing the effectiveness of teachers across schools. With this type of conceptualization, a teacher with a high value-added score in one school may not necessarily receive the same value-added score if they were in a different school. The teacher's value added score is dependent on their position in the distribution of teachers in their school, rather than on their position in the distribution of teachers overall. Turnover models using a VAM score calculated in this way would only provide limited information about the role of effectiveness in turnover

Another complication with the effectiveness and turnover research is that along with not being included in the VAMs, working conditions are also not included in the *turnover* models.

Schools are therefore treated as somewhat monolithic entities, unvarying in the ways that their social and environmental contexts may be contributing to a teachers' decision to leave. Because the teacher effects turnover literature has not accounted for working conditions, and because working conditions may be correlated with teacher effectiveness, a finding that more effective teachers may be more likely to stay could be spurious. The actual case could be that the unaccounted for working conditions are actually driving the relationship. This would occur if more effective teachers sorted into schools with better working conditions, or if working conditions biased the teacher effectiveness measure. In either case, the role of effectiveness in these models may actually be reflecting the role of working conditions in teacher turnover decisions. Therefore, an open question remains about the extent to which the working conditions, and the effectiveness of the teachers, are the drivers of the turnover behavior.

Assuming that working conditions factor into teacher' decisions to stay in their jobs, several possibilities regarding the relationship between teacher effectiveness, *the measure of teacher effectiveness*, and teacher turnover are worthy of consideration. These possibilities arise from the potential that working conditions either do or do not contribute to VAM scores, and that effectiveness may or may not be related to turnover. Together they demonstrate the importance of accounting for working conditions when attempting to obtain a clean estimate of the relationship between teacher effectiveness and turnover. Table 1 presents the matrix of possibilities.

The first possibility is that working conditions contribute to measures of teacher effectiveness and teacher effectiveness is negatively associated with turnover. If this is the case observed relationships between teacher effectiveness and turnover would be partially explained by accounting for working conditions.

A second possibility is that working conditions do not actually contribute to VAM scores, but teacher effectiveness does acts as a buffer against turnover. In this case the relationship between working conditions and turnover, and the relationship between teacher effectiveness and turnover would be independent of one another. Failing to account for both variables simultaneously could still result in biased inferences if more effective teacher sort into schools with better working conditions.

The third possibility is that while working conditions do contribute to VAM scores, teacher effectiveness is not actually related to turnover. If this were the case, accounting for working conditions would partially or fully account for any observed relationship between teacher effectiveness and turnover.

A fourth possibility is that working conditions do not contribute to teacher VAM scores and that effectiveness is unrelated to turnover. In this scenario failing to account for working conditions would only result in a biased inference for the role of teacher effectiveness if more effective teachers sort into schools with better working conditions.

Importantly, the underlying assumption that working conditions are related to turnover may actually be flawed. The observed relationships between working conditions and turnover might occur if effective teachers rate working conditions more highly. More effective teachers may be more likely to have positive perceptions of their work environment, perhaps because

their feelings of success may lend them a predispositions to view their workplace more favorably. Given this possibility, the observed associations between working conditions and reduced levels of turnover may be partially accounted for by positive rating of working conditions given by more effective teachers. This further reinforces the importance of accounting for both teacher effectiveness and working conditions in evaluations of turnover.

**The Potential for an Interaction between Working conditions and Teacher Quality**

If research finds that after accounting for both working conditions and teacher effectiveness both variables are related to turnover, could it also be the case that the role of working conditions is different for teachers of differing ability? Could it be possible that some school contexts are better at retaining more effective teachers? This type of interaction has not yet been explicitly investigated in the literature.

The framework suggested by Johnson and Birkeland, (2003) proposes that the feeling of being successful factors into teacher turnover decisions and that working conditions contribute to these feelings of success by enabling teaching practice. This thinking is reflective of the notion that for effective teachers to be successful, they must work in schools that facilitate their efforts. (Gamoran, Secada, and Marett, 2000). As Morgan and Shakelford (2016) put it, "teachers are central to the mechanism that generates learning, but it is the organization itself that activates the mechanism" (pg. 10). But could effective teachers be more likely to be *activated* by the working conditions in a school?

One aspect of effectiveness may be a teacher's capacity to use the resources and organizational features of a school to enhance teaching practice. A teacher in a school with poor

working conditions, therefore, may perform differently *with the same set of students* in a school with better working conditions. Similarly, the same set of students may not learn as much from a less able teacher than they would from a more able teacher, even in a school with the same working conditions. The relationship between a teacher's ability and the outcomes that their students experience may change based on the quality of the conditions in the school. More able teachers may therefore deliver disproportionately more effective instruction in schools with better conditions.

This relationship may subsequently contribute to differences in turnover outcomes if more able teachers experience disproportionately higher levels of satisfaction from working in schools with better conditions. Grissom (2011), for instance, proposes that the effects of principal leadership in reducing turnover "may have disproportionate impacts on *better* teachers, who may, for example, be more responsive to working conditions than lower quality teachers" (pg. 2580). If such an interaction exists, making improvement to the working conditions in schools may not only contribute to reduced rates of turnover, but may also help ensure that the most effective teachers stay in their schools.

## Summary

Current teacher turnover patterns carry negative consequences for students and schools and constitute a barrier to equal educational opportunity, as teachers leave schools serving poor at higher rates. While research efforts have begun to uncover the ways in which different aspects of teacher quality, and different social and organizational features of the school workplace are implicated in the process, much remains to be learned. Because teacher effectiveness and

working conditions may be correlated in schools, both factors must be included simultaneously in analyses of turnover.

This dissertation contributes to the field by simultaneously accounting for teacher effectiveness and working conditions in the turnover process, and by assessing the potential for and interaction between these variables. Interpretation of the findings from the analysis should point to measures that schools and school districts can take to retain effective teachers. The next chapter describes the analysis that will was conducted.

# CHAPTER 3 - METHOD

Working conditions and teacher effectiveness may both have a direct relationship to teacher turnover. The ways in which working conditions and teacher effectiveness operate *together* to shape teachers' career decisions, however, has yet to be determined. Measures of effectiveness and working conditions have not been simultaneously included in analytical models predicting turnover. As more effective teachers may sort into schools with better working conditions, and as working conditions may bias measures of effectiveness, the full relationship between these variables and turnover may be obscured. The purpose of this analysis was to contribute to the current understanding about turnover by accounting for these potential complications and interrelationships. The analysis also investigated the possibility that the role of working conditions in turnover might be dependent upon the effectiveness of the teacher.

## Data

Analysis of the relationships between teacher turnover, teacher effectiveness, and working conditions requires comprehensive data on each of these constructs. Data needs to be collected in a way that links test scores to students, students to teachers, and teachers' perceptions of their work environments to individual schools. Few existing datasets offer the ability to make all of these connections. Datasets that have up to now been used for teacher turnover research are often missing at least one of these important components. For instance, while the Schools and Staffing Survey and Teacher Follow-up Survey (as used by Ingersoll, 2001) have been instrumental at looking at teacher turnover patterns within a nationally representative sample, the dataset lacks the ability to connect students to teachers. Similarly, among those studies that have looked at teacher quality in turnover, working conditions data

were not collected and were not able to be included in the turnover models (Boyd et. al, 2008; Goldhaber, 2007; Hanushek et al., 2005; Krieg, 2006).

The Measures of Effective Teaching (MET) longitudinal database, however, is unique among currently available datasets in its ability to address some of the gaps in the literature by connecting turnover, teacher performance, and working conditions data. In the MET, students are linked to teachers and teachers are linked to schools. Given the ability of the MET data to link turnover, performance and working conditions, it served as the primary analytic dataset for this study.

The MET project was originally designed to explore several questions related to teaching effectiveness. Funded by a grant from the Bill and Melinda Gates Foundation, the MET collected data on more than 2500 teachers in 317 schools. Topics covered by the MET included assessment of value-added model (VAM) measurement reliability and validity, assessment of what effective teaching looks like and how it is distributed, and the extent of overlap and utility of different measures of effectiveness. The project spanned two years (the 2009-10 and 2010-11 school years) and included teachers in grades 4-9 across six large school districts in the United States. The first year of the project consisted of preliminary data collection which encompassed district administrative data, teacher and student surveys, extensive student test score data, and video recordings of teacher practice. The ability to link data collected in the MET, across school, student, and teacher levels, made the MET data ideal for exploring questions related to teacher effectiveness, working conditions and teacher turnover.

## Sample

The analytic sample includes 1,154 teachers, from 148 schools, who participated in the MET project. The following districts participated in the study: Charlotte-Mecklenburg Schools, NC; Dallas Independent School District, TX; Denver Public Schools, CO; Hillsborough County Public Schools, FL; Memphis City Schools, TN; and the New York City Department of Education, NY. Schools from the participating districts were asked to volunteer for the project. The pool of invited schools was limited to schools serving any grade in the 4th-9$^{th}$ grade range. Schools were offered incentives to participate, including a $1,500 stipend for use at the principal's discretion. Special education schools, alternative schools, community schools, autonomous dropout and pregnancy programs, returning education schools, vocational schools that did not teach academic programs, and schools in which responsibility for a student's learning could not be assigned to an individual teacher were excluded from the sample pool.

Once the schools were selected, teachers in each school were invited to participate. Teachers were excluded from participation if "(a) they were team teaching or looping, making it impossible to assign responsibility for the learning of a given student in a specific subject to that teacher; (b) the teacher indicated that he or she was not planning to stay in the same school and teach the same subject the following year; or (c) there were less than two other teachers with the same grade/subject teaching assignments" (White, Rowan, Alter and Green, 2014, pg. 21). Teachers received a $1,500 incentive for participating. The sample of students, teachers and schools is not nationally representative, nor do the teachers in the sample from each district represent a randomized sample of teachers from the district. Rather, they represent the subset of

teachers to whom it was possible to assign responsibility for student outcomes and who were willing to participate in the study. Despite these constraints, the teachers in the MET sample were similar to those of the broader population of teachers in the districts from which they were drawn in regard to race, years of experience, gender, and the proportion of teachers who possessed a master's degree (Bill and Melinda Gates Foundation, 2012).

The analytic sample in this study also represents a subsample of the teachers from the MET Study. Teachers in the analytic sample were selected based on the criterion that they had data available on all of the variables of interest. As such the sample reflects only those teachers who had valid data on the outcome variable, and excludes teachers who withdrew from the study, were dropped from the study, or were recruited in the second year of the study. The sample was further limited to only those teachers who taught in schools with five or more MET participants. Table 2 presents descriptive statistics on the analytic sample and offers a comparison between the analytic sample and the full sample of MET teachers with valid data on the dependent variable. Despite the reduction in the number of teachers and schools represented in the analytic sample, the samples appear to be very similar across the variables that were used for the analysis. Further discussion on the descriptive statistics for the analytic sample is included in the next chapter.

Attempts to generalize findings from this study should be made with caution, as the study teachers may be different from other teachers in regard to turnover. For instance, teachers willing to participate in the MET may have a greater commitment to education overall and may be more likely than other teachers to remain in teaching. They may also have greater feelings of self-efficacy and see themselves as being more capable than other teachers. Such dispositions, should they be present, might contribute to career related behavioral patterns amongst the MET teachers

that are dissimilar from those of other teachers. MET teacher may be responsive to student compositions, working conditions, and even their own effectiveness in ways that the broader population of teachers may not be.

The analytical sample used in this study also differs from those used in previous research school working conditions and teacher turnover in terms of the student populations represented. Specifically, the sample analyzed in this study contained fewer predominantly White schools and included schools that were, on average, compromised of higher proportions of minority students. For instance, Johnson et. al. (2012) included a sample of schools that were on average 70% White, 14.23% Hispanic, and only 8.71% African American, and Ladd (2011) used a sample of teachers from schools that were on average about 30% Black, and 5% to 10% Hispanic, depending on school level. In contrast, the average school in the analytical sample was 27.26% White, 34.48% Black, and 28.56% Hispanic. To the extent that the relationship between working conditions and turnover varies across schools in a manner that is dependent on the student populations being served, findings that were somewhat different from those reported in these students could be expected.

Despite these characteristics of the sample, the MET data offer a unique opportunity to explore the turnover process on the subset of students, teachers and schools included. Few other datasets allow for the opportunity to link value added measures of teacher effectiveness to survey data on a rich set of working conditions characteristics.

## Operational Definition of Variables

### Outcome

*Teacher Turnover:* The outcome of interest is whether a teacher left their school by the second year of the MET study. This is a dichotomous measure in which 0 = *Did not leave school* and 1 = *Left school*. The variable is drawn from administrative records of the MET study. Each of the participating teachers in the year-one sample were tracked moving into the second year of the study and their status was recorded. Using the item that reflects the year-two status of the teacher, one can identify whether teachers were teaching in the same school from the first year of the study to the second year. The variable does not indicate whether a departing teacher moved to another school or left teaching altogether. From the perspective of the school, however, this distinction may carry little weight as the fact that a teacher has left is more important to the school than where the teacher ends up (see Ingersoll, 2001 for use of a similar approach). Of the 1,154 teachers in the sample, 285 (24.70%) left their school by the second year of the study.

### Student Demographic and Performance Variables

School-level student demographic and performance data was not directly available in the MET data files. While the MET maintained district data on all teachers, students, and schools in the participating districts, these data could not be consistently linked to the study data collected by the MET because observation identifiers were not consistent across files for all study schools. To calculate the school-level demographic and achievement data, I used the available Student by Section File from the MET, which contains data on the MET students who participated in the study. While this data may not include all students in the MET schools, the aggregates calculated can serve as a rough approximation for the corresponding school-level variables. To assess how

well the Student by Sections file would allow for the generation of variables that could serve as proxies for the actual school level aggregates, I compared the aggregates calculated using the Student by Section File to the aggregates of all students for the corresponding schools that *were* available in the District Files maintained by the MET, assuming the School IDs used to link the files were valid. Overall, 171 school matched between the two data sources, 88 of which were included in the dissertation study. The aggregates calculated using the student file from the MET were highly correlated with the corresponding aggregates from the schools from the district files from which data were available. At the school level, correlation coefficients between the two data sources for the proportion of White, Black, Hispanic, and Asian students all exceeded a value of .94. For the school mean student achievement data in ELA and Math correlation coefficients also exceeded .94. Given these findings, I continued with the use of the school-level proxy variables drawn from the Student by Section file for the generation of school-level analysis variables used in the study.

*Student ethnicity*: The student race variables were then transformed into a dichotomous variable reflecting whether a school was comprised of predominantly White students or predominantly minority students. Schools that had 50% or less White students were coded as being predominantly minority. This categorization of schools has been used previously in the literature on school segregation (Frankenberg, Lee, & Orfield, 2003). This categorization was also preferred, relative to a more continuous specification like percent White, or percent Black, due to the lack of schools in the sample with student populations that were greater than 90% White. To the extent that previously identified relationship between race and turnover have been driven by teacher behavior in these highly predominantly White environments, a continuous variable might

end up understating the relationship because of the inability to capture this end of the range using the MET sample. The dichotomous specification allows for a simpler comparison to be drawn across school types. To assess the extent to which this choice impacted the calculation of the coefficients for other variables included in the analysis, a set of models was run using school percent Black and school percent Hispanic as the school-level student race variables. These models, included in Appendix B, indicated null to slight changes in the coefficients for the other variables in the corresponding models[1].

*Previous test performance:* Student previous test performance was available as the within district, subject, and grade rank-based z-scores for the students in the previous year's (2008-09) state administered Math and ELA tests. Separate school-level aggregates were calculated as the school-average of the scores for each content area test. These school-level prior achievement variables were closely related, sharing a correlation coefficient of 0.96 at the school level. To avoid issues of collinearity, only the variable reflecting prior achievement in ELA was used in the analysis. As this variable had an interpretable zero value, it remained un-centered.

*Exclusion of School-level FRL status*: Of the 1,154 teachers in the focal sample, 234 (20.27%) did not work in a district that had FRL status included in the MET District Data files. This student-demographic variable was therefore not included in the main analysis. For a robustness check, I ran sub-analyses on the subsample that included the FRL variable and found no statistically significant relationship between FRL and the turnover outcome, in either baseline models or models which included the main analysis variables.

[1] Corresponding models can be identified with model numbers.

**Teacher Demographic Variables**

The MET collected a typical set of teacher demographic variables that have been used in previous studies and have been shown to be important correlates of teacher turnover. This section describes the original variables that were included in the MET data and provide details on how each was treated in the analysis.

*Teachers' Gender* was captured as a dichotomous variable that takes the value of zero (0) for females and one (1) for males and was collected from the district administrative files in the first year of the study. In the analytic sample, 17.16% of the teachers are male, a smaller but comparable value to the national percentage of 23.9% in the 2011-12 school year (Ingersoll et al., 2014).

*Teachers' Race/Ethnicity* was similarly collected from the district administrative files and transformed by the MET researchers into a series of dummy variables that capture individual teachers' ethnicity as: White, Black, Hispanic, and Other race. In the analytic sample, 65.42% of teachers identify as White, 27.30% identify as Black, 5.37% identify as Hispanic and 1.91% indicated inclusion in the *Other* category. Overall, the analytic sample contains a smaller percentage of White teachers compared to the national percentage of 82.7 (Ingersoll et al., 2014). This suggests a higher proportion of non-White teachers working in MET districts compared to other districts in the country.

*Teachers' Grade Level of Instruction* was collected by the MET through teacher surveys administered once during the study. Grades range from grade 4 - grade 9 with the vast majority of teachers having only one grade associated with them. Six teachers taught in multiple grades and were excluded from the sample. The grade variable was transformed into a dichotomous dummy variable indicating whether teachers taught at elementary school grade level or in the middle school or higher school grade level. In the sample 37.26% of teacher taught at the elementary level, while 6.47 taught at the middle and high school grade level[2].

*Teachers' Subject of Instruction* was collected by the MET through teacher surveys administered once during the study. Data was stored as a categorical variable which will be transformed into a series of dummy variables. These dummy variables captured subject as: ELA, Math, and a combined Math and ELA, or Generalist, category. The generalist category served as the referent group in the analytic models. In the analytic sample, 40.12% of teachers taught ELA, 35.88% taught Math, and 24.00% were generalists.

*Teacher Years of Experience* was collected by the MET through the Teacher Working Conditions survey. For this study, teacher experience was treated as a dichotomous variable, distinguishing between new teachers, defined as a teacher who was in their first three years of teaching, and teachers with more than three years of experience. The analytic sample was comprised of 19.24% new teachers and 80.76% teachers with more than three years of experience. Overall, the sample was comprised of teachers with less experience than the national

[2] Sub analyses using the individual grade levels revealed not statistically significant association with the turnover outcome.

teacher labor pool, as 62% of the sample had ten or fewer years of experience, compared to 45% nationally in 2011-12 (Ingersoll et al., 2014).

**Measures of Teacher Effectiveness: Teacher value-added model scores**

Teacher effectiveness was reflected by a single VAM score calculated by the MET researchers. The purpose of a VAM is to identify a teacher's independent contribution to student learning (Harris, 2011). The most basic form of value-added model is the linear regression form (OECD, 2008). In this form, student test scores are regressed on prior test performance and a set of adjustment covariates. Predicted values, based on the model, are calculated and stored for each student. Predicted values are then subtracted from observed values for each student, yielding a difference score. Students are linked to teachers and the value-added score for each teacher is calculated as the average difference score of the students in the teacher's class. The value-added approach of the MET takes the linear regression form. Student test scores at the end of the year are modeled as a function of individual student characteristics including a baseline score, aggregated characteristics for the students in the same class, and an error term. The teacher value-added estimates are obtained by averaging the standardized residuals for the students in the teacher's class.

VAM scores were calculated using tests administered by the MET project staff: the SAT-9 Open Reading Assessment and the Balanced Assessment in Mathematics (BAM) for grades 4-8, and the ACT Quality Core assessments for Algebra I and English 9 for students in 9$^{th}$ grade. Value added scores were calculated for the different tests separately, and, as mentioned, scores were calculated to be grade and district specific. Because the SAT-9, BAM, and ACT tests were

only administered to students participating in the MET, VAM scores calculated using the exams are reflective of the distribution of teachers participating in the MET. VAM scores used in this study therefore do not provide a measure of teacher effectiveness relative to all other teachers, but only relative to teachers in the MET. Subject matter generalists who taught both Math and ELA had corresponding VAM scores for each subject. For these teachers, one subject was selected at random and the VAM score for that subject was used.

The estimation model is given as:

$$S_{it} = X_{it}\beta + \bar{X}_{jkt}\gamma + \theta_{(t-1)} + \lambda Z_{jk(t-1)} + \varepsilon it$$

In this model[3] $S_{it}$ represents the test score for student *i* in the 2009-10 school year. Student demographic characteristics are represented $X_{it}$ and $\beta$ represents the coefficients (associated change in test score of a one unit change in the student demographic variable) associated with those variables. Class-level aggregates of the student demographic variables are reflected in $\bar{X}_{jkt}$ and γ represents the coefficients associated with those variables. The individual student's test performance in the content area for the previous year is reflected in $\theta_{(t-1)}$ (a coefficient term was not indicated in the MET Users Guide, though it was likely calculated as it would be required for the VAM score calculation) and class averages for the same variables are reflected in $Z_{jk(t-1)}$, with $\lambda$ as the coefficient for the variables. The student specific test scores were first converted to rank-based z-scores before being entered in the model. Deviations from expected values, conditional on the inclusion of the variables in the model, for student *i* on test *t* are

[3] Given that different sets of student demographic variables varied by district, the VAMs for each district differed slightly in the sets of demographic variables that were included.

reflected in $\varepsilon it$. As noted, teacher VAM scores are calculated as the per-class average of these deviations for the students in the teacher's class (White et al., 2014). Given the structure of the model, a number of unaccounted for variables may contribute to the value of the $\varepsilon it$ and subsequently to teachers' VAM scores. These unaccounted for variables could include such things as the working conditions in the school. This is a central consideration of the analytical approach, and the incorporation of working conditions variables to the models of effectiveness and turnover.

In VAMs the effect calculated for a given teacher is not conceptually the same as the effect in many randomized control trials where students in a treatment condition are compared to students who did not receive a treatment. When dealing with school and teacher effects no clean "control condition" exists for students to be assigned to. All students are subject to some degree of "treatment" simply by being in a class with a teacher. Effects in VAMs are therefore calculated not in terms of how a teacher compares to the absence of a teacher, but rather show how teachers compare to other teachers. In the case of the MET, teachers are compared against other MET-participating teachers in the same grade and district. While VAMs have been criticized for their overuse in accountability decisions, and their inability to fully identify the causal impact that an individual teacher has on student learning (American Education Research Association, 2015), they are still the most advanced quantitative descriptive tool for measuring associations between teachers and student test score gains.

**Working Conditions Variables**

Working conditions shape instructional practice and teachers' affective responses to their schools. This analysis sought to expand understanding of the role of working conditions in turnover, and to explore how working conditions are related to other measures. The primary approach to measuring working conditions constructs in the literature has been to use items, independently or in combination, from teacher surveys administered as part of the studies (see Ingersoll, 2001 and Johnson et al., 2012 for examples). In this study, measures of working conditions were drawn from the Teacher Working Conditions Survey (TWC) conducted by the MET. The survey was administered to all teachers in MET schools in the first year of the study. Cronbach alphas and intracalss correlations (ICC), calculated for the MET sample, were provided for each of the individual working conditions scales by Ferguson and Hirsh (2014). Cronbach alphas reflect the similarity in responses from teachers on items in each scale and the ICC represent the proportion of variation in each scale that exists between schools. For items in each scale, teachers were often asked to indicate, on a Likert scale format, the extent to which they agreed or disagreed with statements about their school and teaching experience. They were also asked about the amount of time in which they engaged in certain activities (e.g. *None* to *More than 10 hours)* or how much of a role they had in certain activities in the school (e.g. *No role at all* to *Large role*). The individual scales reflected in the MET Teacher Working Conditions Survey are described below:

*Manageable demands on time [Time]* (alpha = .82, ICC = .178): Having sufficient time for instruction and instruction related activities has been shown to be related to teachers' intentions to stay in their schools (Ladd, 2011). Items in this scale focus on the extent to which teachers believe they have sufficient time to teach and to prepare to teach. For example, teachers are

asked the extent to which they agree that "Teachers have sufficient instructional time to meet the needs of all students." I expected that teachers who reported feeling that they have more time will be more likely to stay in their school. The mean scale score for teachers in the sample was 50.57 (sd = 8.50) and school value was 50.34 (sd = 4.81).

*Facilities and Resources [Resources]* (alpha = .87, ICC =.242): Working in poorly maintained environments, and having access to few instructional resources, teachers may find it challenging to perform their work effectively. Here, the facilities and resources scale will be used to investigate the topic. An example item asks teachers the extent to which they agree with the statement "Teachers have sufficient access to appropriate instructional materials." Given previous findings on the relationship between facilities and resources and turnover, I did not expect that the variable will be found to be predictive of turnover after accounting for other working conditions, which may be more directly impactful. The mean teacher in the sample had a scale score value of 50.52 (sd = 9.79) and the mean school value was 50.45 (sd = 5.56).

*Community Support and Involvement [Comm. Supp.]* (alpha = .90 ICC =.400): The role of community relationships has not been fully established in the turnover literature, though it appears that this workplace condition may not be closely related to turnover. The analysis will use the Community Support and Involvement scale in the hopes of clarifying the relationship between this construct and turnover. An example item from the scale asks teachers how much they agree with the statement "This school does a good job of encouraging parent/guardian involvement." I did not expect to find a relationship between this variable and turnover. The

mean scale score for teachers in the analytic sample was 50.08 (sd = 6.92), with a mean school value of 49.79 (sd = 7.15).

*Student Conduct Management [Stu. Cond.]* (alpha = .88, ICC =.344): Teacher perceptions of student behavior have been demonstrated to be related to teacher turnover outcomes (Ingersoll, 2001; Johnson et al., 2005; Kukla-Acevedo, 2009). Given the consistency of this workplace condition construct in predicting turnover, failing to account for it could lead to mistaken inferences about the role of other working conditions. In the TWC particular focus is given to the ways in which schools are organized to support teachers in managing student conduct. An example item from the scale asks teachers the extent to which they agree with the statement "Students at this school follow rules of conduct." I expected that teachers who experienced more support in managing student conduct would be more likely to remain in their schools. The mean teacher had a Student Conduct Management scale score of 49.91 (sd = 9.83), and the mean school had a mean score of 50.01 (sd = 6.68).

*Teacher Leadership [T. Lead.]* (alpha = .93, ICC =.276): Teacher autonomy and influence in decision making in their schools have been linked to turnover though they are not consistently found to be predictive of turnover when other factors are accounted for. To explore the extent which this aspect of the teaching experience matters for teachers in the MET, the Teacher Leadership scale was included in the analysis. An example item asked teachers about the extent to which they agree that "Teachers are relied upon to make decisions about educational issues." The mean teacher scale score in the analytic sample was 50.26 (sd = 8.84) and the mean school mean scale score was 50.28 (sd = 5.35).

*School Leadership [S. Lead]* (alpha = .96, ICC = .241): Of the different working conditions constructs, school leadership has probably received the most attention in the turnover literature and has been consistently shown to be negatively associated with turnover (Ingersoll, 2001; Johnson et al., 2012; Ladd, 2011; Boyd et al., 2011; Kukla-Acevedo, 2009). In general, the more positively teachers view the leadership in their school, the less likely they will be to leave. The School Leadership scale was therefore included in the analysis. An example item asks teachers how much they agree that "The school leadership consistently supports teachers." Given the consistency of findings associated with this variable, I expected to find a negative relationship between School Leadership and turnover. The mean teacher in the sample had a scale score of 49. 83 (sd = 8.79) and mean school mean was 49.88 (sd = 5.02).

*Professional Development [PD]* (alpha = .93, ICC = .157): Appropriate and adequate professional development may be a central to helping teachers improve their practice (Darling-Hammond, 2010) though professional development opportunities do not generally appear to be related to turnover. To clarify the role of this potentially meaningful construct, the Professional Development scale was used in the analysis. An example item asked teachers the extent to which they agreed with the statement "Professional development enhances teachers' abilities to improve student learning." The mean teacher had a Professional Development scale score of 49.92 (sd = 9.30) and the mean school mean for the scale was 50.05 (sd = 4.79). Given the findings from previous research on the topic, I did not expect that a relationship between Professional Development and turnover would be found.

*Instructional Practice and Support [Inst. Supp]* (alpha = .81, ICC = .125): The Instructional Practice and Support scale is reflective a broad set of constructs that have received various degrees of attention in the turnover literature. For instance items relate to teacher innovation, but also to teachers' perceptions of the capabilities of other teachers and students. Example items asked teachers the extent to which they agreed that "Teachers are encouraged to try new things to improve instruction," and that "Teachers in my school have what it takes to get children to learn." For the Instructional Practice and Support scale, the mean teacher had a score of 50.88 (sd = 9.49) and the mean school mean was 50.71 (sd = 4.42). To the extent that the Instructional Practice and support scale enables teacher to feel successful in their teaching efforts, and to the extent that such feelings of success are related to turnover, higher scale scores were expected to be negatively associated with turnover.

*Working Conditions Composite Variable:* Using the eight working conditions scales available in the MET, I also calculated a working conditions composite variable that would serve as an indicator of the teachers' overall impressions of the working conditions in their schools. This variable was calculated as the simple arithmetic mean of the individual working conditions scale scores for each teacher in the sample, and followed a similar specification as used by Johnson et al., 2012. The working conditions composite variable served as the primary working conditions variable used in the analysis. The mean teacher in the sample had a score of 50.24 (sd = 7.35), while the mean school mean for the variable was 50.20 (sd = 4.62).

When using working conditions constructs measured through survey items, multiple approaches can be used in the construction of the variables. Working conditions can be

conceived of at the individual teacher level, the aggregate school level, or both. While individual teacher perceptions may have the most direct relationship to individual teacher turnover decisions, aggregated measures of these perceptions may provide better reflections of how schools are operating overall.

For this analysis, I used a set of different operationalizations for the working conditions variables, each reflective of distinct aspects of teachers' perceptions of their workplace. The first of these operationalizations was the simple individual teachers response score (*Raw Score*) on the working conditions composite variable. This variable served to reflect the individual teacher's perception of the working conditions in their school. I then decomposed this individual score into a school mean component and an individual teacher deviation score. The school mean value (*School Mean*) was calculated as the simple arithmetic mean of the individual teacher raw score values for the teachers in a given school. The value represented the overall teacher perceptions of the working conditions for the responding teachers within a given school. After the school mean values were obtained, individual teacher deviations (*Teacher Deviation*) were then calculated as the difference between the teachers' individual raw score and the school mean value. This variable served as a reflection of the extent to which teachers differed from the other teacher in the school in terms of their perceptions of the working conditions. Teachers with higher deviation scores reported having more positive views of their workplace than the other teachers in their schools.

One advantage of calculating the teacher deviation score along with the school mean teacher perception of the working conditions, is that is allows for both a school-level variable for the working conditions and an individual level variable to be included in analytical models at the same time. Attempting to include the teacher raw score in a model along with a school mean

value would result collinearity issues since the school mean is already included as a component of the teacher raw score value. This is demonstrated in the following equation describing the relationship between these values:

**(Eq. 1) Teacher Raw Score** = **School Mean** teacher perception + **Teacher Deviation**.

Because of this relationship, using the teacher deviation score along with the school mean value is preferred to using the teacher raw score with the school mean in the analytical models. This approach is consistent with the *contextual effects* framework that has been used in other areas of education research (Raudenbush & Bryk, 2002). Willms (1986), for instance, uses a contextual effects framework to model the relationship between school and student SES characteristics on student achievement.. The primary motivation behind the using the contextual effects framework in this study was the fact that it allows for a school level value and an individual level value of a construct to be included in an analytical model simultaneously. Therefore, the terms "contextual effects" and "contextual effects framework" in this dissertation are simply used to refer to models which include both the school mean working conditions variable and the teacher deviation score.

## Analytical Approach and Modeling Strategy

### Relationship between School Working Conditions, Student Characteristics, and Teacher Turnover

In the first stage of the analysis I explored the relationship between school working conditions and teacher turnover. Across schools, minority and lower achieving students tend to be enrolled in schools with poorer working conditions. Failing to account for student characteristics may result in an over estimation of the relationship between working conditions and turnover. On the other hand, working conditions may partially or fully account for the observed relationships between student characteristics and turnover. Given these possibilities, I investigated the question of whether working conditions are predictive of turnover, after accounting for student characteristics, and whether working conditions helped to explain any observed relationships between student characteristics and turnover. Given that working conditions may factor into teachers' feeling of success and given the findings from previous studies on this topic, I expected to find that working conditions would be predictive of turnover, and that they would partially explain the association between student characteristics and turnover.

I started by running descriptive and correlational analyses on teacher characteristics, school enrollment characteristics and school working conditions. The focus was on determining the extent to which student demographic characteristics were correlated with working conditions or, put another way, whether teachers in predominantly minority schools viewed their working conditions as being worse. Based on the relationships found between these variables in the extant literature, I expected that this would be the case. Such a correlation might be an indicator that

student characteristics in turnover models are an endogenous variable, appearing to be drivers of turnover because of their relationship to working conditions.

I explored this possibility in the next stage of the analysis where I used multilevel modeling techniques to estimate the relationships between working conditions, student characteristics and turnover. Specifically, I used Hierarchical-linear modeling (HLM), a regression technique that explicitly accounts for the nested structure of data where observations are grouped within larger units (Raudenbush & Bryk, 2002). This is appropriate for this sample where teachers are nested in schools. I started by establishing a baseline comparison point by looking at how turnover outcomes vary between schools when not accounting for the other variables. To do this, I used the following model:

$$\log\left(\frac{\pi_{ij}}{1-\pi_{ij}}\right) = \beta_{0j}$$

Where:

$$\beta_{0j} = \gamma_{00} + \gamma_{01}\,\mathbf{D}_j + u_{0j}$$

Here $\log\left(\frac{\pi_{ij}}{1-\pi_{ij}}\right)$ represents the log odds of turnover, or the log odds of a teacher leaving their school from the first year of the study to the second year, for teacher *i* in school *j*. $\gamma_{00}$ is the mean intercept in the log odds of turnover for schools. **D** represents a vector of dummy variables for specific districts, and $\gamma_{01}$ is the change in the difference in the intercept associated with the school's district. The unique increment to the outcome associated with school *j* is represented by $u_{0j}$ which has mean of zero and a variation of $\tau_{00}$. Given that school-level student characteristics and working conditions have been shown to be associated with turnover, and given that these characteristics vary across schools, I expected to find variation in the $u_{0j}$.

HLM can help determine the extent to which school-level working conditions variables account for the variation in turnover outcome that exists between schools, by decomposing the variation in the outcome into between-group and within-group portions. Compared to this baseline model, models in which all of the school-level factors related to turnover have been included would have no remaining *between school* variance to be accounted for. In this case, the variables included in the model would fully account for the differences in school-level factors that are related to turnover. Alternatively, in models that do not include all school-level factors related to turnover, remaining between school variance would still be evident.

I explored these possibilities by calculating the interclass correlation, indicating the portion of variability in the outcome that is attributable to between school differences, for each of the models run and compared them to the intercept only model presented above. Decreases in the variation and intra-class correlation that occurred in more complex models, when the working conditions and student characteristics were included, indicated the extent to which those variables account for the between school variation in the outcome. Along with intraclass correlation coefficients, I also calculated Akaike information criteria (AIC) values (Akaike, 1973) for each of the models run. AIC is a measure of model fit that accounts for the number of parameters in the model. The calculation therefore balances parsimony against the ability of the model to fit the data. Smaller values indicate better overall fit.

In the next model, I established the base relationships between teacher characteristics and turnover, when not including school-level variables. I added the teacher characteristics to the intercept only model, along with dummy variables indicating the teachers' district. District dummy variables offer the closest proxy for the teacher labor market contexts of the districts participating in the study. While the role of these characteristics will not be directly observable,

including district fixed effects reduced the likelihood that market conditions contaminate the estimates for the other variables. The model took the following form:

$$\log\left(\frac{\pi_{ij}}{1-\pi_{ij}}\right) = \beta_{0j} + \beta_1 \mathbf{T}_{ij}$$

Where:
$\beta_{0j} = \gamma_{00} + \gamma_{01}\,\mathbf{D}_j + u_{0j}$
$\beta_{1j} = \gamma_{10}$

Here **T** represents a vector of teacher demographic and background characteristics, including teachers' sex, ethnicity, level of teaching experience, grade level, and subject. **D** represents a vector of dummy variables for specific districts.

- $\gamma_{00}$ is the mean intercept in the log odds of turnover for schools.
- $\gamma_{10}$ is the change in the log odds of turnover for a teacher associated with a one unit change in teacher characteristics[4]. In the case of dichotomous dummy variables, $\gamma_{10}$ is the chance in the log odds of turnover for a teacher in the focal category relative to the referent category.
- $\gamma_{01}$ is the change in the difference in the intercept associated with the school's district.
- $u_{0j}$ is the unique increment to the intercept associated with school *j.* The $u_{0j}$ are assumed to have a mean of zero and a variance of $\tau_{00}$.

[4] For this and the following models, coefficients for all covariates are interpreted as be conditional on the other covariates included in the models.

I expected that women, White teachers, and teachers with the least experience would be more likely to turnover than other teachers. These trends would be indicated by statistically significant values for the $\gamma_{10.}$

Next, I established the baseline relationships between student characteristics and turnover, when not accounting for working conditions, by running models that introduced the school-level student characteristics. The models took the following form:

$$\log\left(\frac{\pi_{ij}}{1-\pi_{ij}}\right) = \beta_{0j}$$

Where:
$\beta_{0j} = \gamma_{00} + \gamma_{01}\,\mathbf{D}_j + \gamma_{02}\,\mathbf{STU\_S}_j + u_{0j}$
$\beta_{1j} = \gamma_{10}$
$\beta_{2j} = \gamma_{20}$

Here **D** represents the same vector of district dummy variables as before and **STU_S** represents the race and prior-achievement variables aggregated at the school level. The $\gamma_{00,}$ $\gamma_{01,}$ and $u_{0j}$ keep the same interpretations as in the previous model.

- $\gamma_{02}$ is the change in the school intercepts associated with a one unit change in the school-level student demographics at the school.

Overall, because working conditions are not yet included in this model, I expected to find that teachers in schools that were predominantly minority and had lower achieving students would be more likely to leave their jobs. These results would be indicated by statistically significant values for the $\gamma_{02,}$ with positive values for the predominantly minority school variable and negative values for the mean student achievement variable.

I then continued to establish the baseline relationships between student characteristics, teacher characteristics and turnover by running a model that included the student characteristics along with the teacher demographic variables. This model also served as a comparison against which the more complex models would be evaluated. The model took the following form:

$$\log\left(\frac{\pi_{ij}}{1-\pi_{ij}}\right) = \beta_{0j} + \beta_1 \mathbf{T}_{ij}$$

Where:
$\beta_{0j} = \gamma_{00} + \gamma_{01}\,\mathbf{D}_j + \gamma_{02}\,\mathbf{STU\_S}_j + u_{0j}$
$\beta_{1j} = \gamma_{10}$
$\beta_{2j} = \gamma_{20}$

Here **T** and **D** represent the same vector of teacher characteristics and district dummy variables as before, and **STU_S** represents the race and prior-achievement variables at the school level. The $\gamma_{00}$, $\gamma_{10}$, $\gamma_{01}$, and $u_{0j}$ keep the same interpretations as in the previous model.

- $\gamma_{02}$ is now the change in the school intercepts associated with a one unit change in the school-level student demographics.

In this model I expected to find little if any changes from the corresponding coefficients calculated in the earlier models.

*Raw Teacher Scale Scores*

I then investigated the relationship between working conditions and turnover and explored whether including working conditions in the model helped to explain any observed associations between student characteristics and turnover. As a first step in the process I sought to establish the relationship between the different working conditions variables and turnover, not conditioning on student or teacher characteristic variables. The different forms of the working conditions variables were iteratively entered into the models. For simplicity, however, the

models are described below with the inclusion of the teacher and school-level control variables. For each of these models, results are reported for both the versions that exclude the teacher and student control variables and the versions that include those variables. The first model, which included the raw teacher scale score on the working conditions composite variable, took the following form:

$$\log\left(\frac{\pi_{ij}}{1-\pi_{ij}}\right) = \beta_{0j} + \beta_1 \mathbf{T}_{ij} + \beta_2 \mathbf{TWC}_{ij}$$

Where:
$\beta_{0j} = \gamma_{00} + \gamma_{01} \mathbf{D}_j + \gamma_{02} \mathbf{STU\_S}_j + u_{0j}$
$\beta_{1j} = \gamma_{10}$
$\beta_{2j} = \gamma_{20}$

Here **T** and **D** represent the same vector of teacher characteristics and district dummy variables as before and **STU_S** represents the same set of school-level student characteristic variables. **TWC** represents the teacher's scale score on the working conditions composite variable. The $\gamma_{00}$, $\gamma_{01}$, $\gamma_{10}$, $\gamma_{02}$, and $u_{0j}$ keep the same interpretations as in the previous models.

- $\gamma_{20}$ is the change in the log odds of turnover for a teacher associated with a one unit change in teacher perceptions of the working conditions, relative to the grand mean.

Given findings from earlier studies on the topic (Johnson et al. 2012; Ladd, 2011), I expected that the teacher perceptions of the working conditions would be negatively associated the teacher's probability of turnover, and that this would hold true even when controlling for other teacher and school-level variables. This relationship would be evidenced by a statistically significant negative value for the $\gamma_{20}$. I also expected that once the teacher perceptions of the

working conditions were included in the model they would explain the observed association between the student demographic characteristics and turnover. This would manifest as the $\gamma_{02}$ becoming closer to zero when compared to the models that did not include the working conditions variable.

*School Mean Teacher Perceptions*

In the next model the relationship between the school mean of the teacher perceptions of the working conditions and turnover were established. An important distinction from the previous model is that now working conditions were entered at the school level, rather than in individual teacher level. The models took the following form:

$$\log\left(\frac{\pi_{ij}}{1-\pi_{ij}}\right) = \beta_{0j} + \beta_1 \mathbf{T}_{ij}$$

Where:
$\beta_{0j} = \gamma_{00} + \gamma_{01}\mathbf{D}_j + \gamma_{02}\mathbf{STU\_S}_j + \gamma_{03}\mathbf{SWC}_j + u_{0j}$
$\beta_{1j} = \gamma_{10}$
$\beta_{2j} = \gamma_{20}$

Here **T** and **D** represent the same vector of teacher characteristics and district dummy variables as before and **STU_S** represents the same set of student characteristic variables. **SWC** represents the school mean teacher perceptions of the working conditions. The $\gamma_{00}$, $\gamma_{01}$, $\gamma_{10}$, $\gamma_{02}$, and $u_{0j}$ keep the same interpretations as in the previous model.

- $\gamma_{03}$ is the change in the log odds of turnover for a teacher associated with a one unit change in the school mean teacher perceptions of the working conditions, relative to the mean school mean.

As with the previous model, I expected that the school mean working conditions would have a negative association with turnover, such that teachers who were working in schools that were on average perceived as having better working conditions would be less likely to turnover. In this model this would appear as a negative value for the $\gamma_{03}$. I also expected that, as with the previous model, the coefficients for the student demographic variables would be nearer to zero in this model than they would in the model with any working conditions variables. In this model this would be evident as a mitigation in the $\gamma_{02}$.

*Teacher Deviations from the School Mean*

The next model established the association between the teachers' deviation from the other teachers in the same school of their perception of the working conditions. This model, which substituted out the school mean perceptions of working conditions, had the following form:

$$\log\left(\frac{\pi_{ij}}{1-\pi_{ij}}\right) = \beta_{0j} + \beta_1 \mathbf{T}_{ij} + \beta_2 \mathbf{DEV\_WC}_j$$

Where:
$\beta_{0j} = \gamma_{00} + \gamma_{01} \mathbf{D}_j + \gamma_{02} \mathbf{STU\_S}_j + u_{0j}$
$\beta_{1j} = \gamma_{10}$
$\beta_{2j} = \gamma_{20}$

Here **T** and **D** represent the same vector of teacher characteristics and district dummy variables as before and **STU_S** represents the same set of student characteristic variables. **DEV_WC** represents the teacher deviations from the school mean teacher perceptions of the working conditions. The $\gamma_{00}$, $\gamma_{10}$, $\gamma_{01}$, $\gamma_{02}$, and $u_{0j}$ keep the same interpretations as in the previous model.

- $\gamma_{20}$ is the change in the log odds of turnover for a teacher associated with a one unit change in the teacher deviation from the school mean teacher perceptions of the working conditions.

In this model I expected that there would be a statistically significant negative relationship between the teacher's deviation score and the probability that they would leave their school. In other words, I expected that when teachers viewed the working conditions in their school as being more positive than the other teachers in the same school did, they would be less likely to leave. This relationship would appear as a negative value for the $\gamma_{20}$. I did not expect that including the teacher deviation score would result in a mitigation of the coefficients for the school-level student demographic variables, as the deviations are inherently independent of the school-level working conditions variables, and therefore any associated school-level student demographic variables.

*Contextual Effects Model*

I then introduced the contextual effects framework, in which both the school mean working conditions and the individual teacher deviation values were included simultaneously, in the next model. The model took the following form:

$$\log\left(\frac{\pi_{ij}}{1-\pi_{ij}}\right) = \beta_{0j} + \beta_1 \mathbf{T}_{ij} + \beta_2 \mathbf{DEV\_WC}_{ij}$$

Where:
$\beta_{0j} = \gamma_{00} + \gamma_{01} \mathbf{D}_j + \gamma_{02} \mathbf{STU\_S}_j + \gamma_{03} \mathbf{SWC}_j + u_{0j}$
$\beta_{1j} = \gamma_{10}$
$\beta_{2j} = \gamma_{20}$

Here **T** and **D** represent the same vector of teacher characteristics and district dummy variables as before and **STU_S** represents the same set of student characteristic variables. **SWC** again represents the school mean teacher perceptions of the working conditions. The $\gamma_{00}, \gamma_{01}, \gamma_{10}, \gamma_{02},$ and $u_{0j}$ keep the same interpretations as in the previous model.

- $\gamma_{20}$ is the change in the log odds of turnover for a teacher associated with a one unit change in the teacher's deviation from the school mean teacher perceptions of the working conditions.
- $\gamma_{03}$ is the change in the log odds of turnover for a teacher associated with a one unit change in the school mean teacher perceptions of the working conditions, relative to the mean school mean.

As with the previous models I expected that both the school mean teacher perception of the working conditions and the individual teacher's deviation score would be negatively associated with turnover. This finding would result in negative values for both the $\gamma_{20}$ and the $\gamma_{03}$. Because the school-level variable of the working conditions was again included in this model, I also expected that the $\gamma_{02}$, reflecting the association between the student demographic variables and turnover would be mitigated in comparison to the corresponding coefficients from the models that did not include the working conditions variables.

After establishing the relationship between the contextual effects framework components of the working conditions composite variable and turnover, I ran a series of models that focused on the individual working conditions scales. For each of the eight scales I used the same model structed as described for the contextual effects model of the composite working conditions

variable. The only difference was that instead of the school mean value of the teacher perception on working conditions composite variable, and the teacher deviation score from those means, I used the school mean values for the individual scales and I used the teacher deviations corresponding with each scale. Using the individual scales, I did not expect that all of the working conditions variables would necessarily be related to turnover. Some, like school leadership, are more consistently found to be predictive turnover than others, like professional development. Additionally, I expected that the different working conditions scales would vary in the extent to which they explained the higher rates of turnover in predominantly minority schools. If certain scales were more closely associated with student racial compositions, including them in the analytical models would do more to mitigate the coefficients for the predominantly minority school variable than would other scales.

**Relationship between Teacher Effectiveness and Teacher Turnover**

With the next stage of the analysis, I turned to the relationship between teacher effectiveness, as measured by VAM scores, and teacher turnover. Rational actor models suggest that more effective teachers may have higher rates of turnover because they may have more options for relocation than other teachers. Alternatively, if being successful in their school is a deterrent against turnover, more effective teachers may actually be less likely to turnover. So, to what extent is teacher effectiveness related to turnover? To determine the answer to this question I ran a set of regression models that predicted turnover using teacher VAM scores, one without control variables, and one that included other teacher and school characteristics. For simplicity, I describe the model that included control variables below. The model took the following form:

$$\log\left(\frac{\pi_{ij}}{1-\pi_{ij}}\right) = \beta_{0j} + \beta_1 \mathbf{T}_{ij} + \beta_2 \mathbf{TE}_{ij}$$

Where:
$\beta_{0j} = \gamma_{00} + \gamma_{01}\,\mathbf{D}_j + \gamma_{02}\,\mathbf{STU\_S}_j + u_{0j}$
$\beta_{1j} = \gamma_{10}$
$\beta_{2j} = \gamma_{20}$

Starting with the earlier model that included teacher characteristics and student characteristics, this model adds in teacher effectiveness. Here **T** and **D** represent the same vector of teacher characteristics and district dummy variables as before and **STU_S** represent the same set of student characteristic variables as in the earlier models. The $\gamma_{00}$, $\gamma_{10}$, $\gamma_{01}$, $\gamma_{02}$, and $u_{0j}$ also keep the same interpretations as before. The new addition to the model, **TE**, represents teacher effectiveness as measured by the MET VAM. The parameter of interest is $\gamma_{20}$.

- $\gamma_{20}$ is the change in the log odds of turnover for a teacher associated with a one unit change in teacher effectiveness.

I hypothesized that more effective teachers would be less likely to turnover, a relationship which would be indicated by a negative value for $\gamma_{20}$. Assuming that the MET VAM score is a clean measure of teacher effectiveness, I thought it would be reasonable that teachers with higher scores would experience greater feelings of success and would therefore want to continue working in their positions. Additionally, while the rational actor model suggests that better teachers may have more options to move to other schools, teacher effectiveness may not be a signal that other schools consider in their hiring decisions in the same way that they consider the more readily available markers of teacher qualifications. More effective teachers may therefore

not actually have more options than other teachers with the same qualifications, and would not be more likely to turnover.

Importantly, a negative value for $\gamma_{20}$ in this model might also indicate that working conditions influence VAM scores, or that more effective teachers select into schools with better working conditions. These possibilities were addressed in the next stage of the analysis.

**Relationships between Working Conditions and Teacher Effectiveness**

In the next stage of the analysis I assessed the relationships between working conditions and teacher effectiveness in the turnover process. Specifically, I aimed to determine the extent to which observed associations between teacher effectiveness and turnover are conditional on working conditions. When not accounting for working conditions, teacher effectiveness may be an endogenous variable in a model predicting turnover.

To explore this possibility, I started by calculating single order correlations between teacher effectiveness and school working conditions. If effective teachers did sort into schools with better working conditions, or if working conditions contributed to MET VAM scores, these relationships would be expected to appear in the correlation coefficients. Given that teachers are inequitably distributed across schools, and given the common perception that working conditions enable successful teaching, I expected to find a positive correlation between these variables.

I then ran a set of regression models to determine whether the coefficients for the teacher effectiveness variables would change in the presence of each of the different working conditions variables, conditioning on other teacher and school characteristics. For simplicity, the model representing the contextual effects framework is presented below:

$$\log\left(\frac{\pi_{ij}}{1-\pi_{ij}}\right) = \beta_{0j} + \beta_1 \mathbf{T}_{ij} + \beta_2 \mathbf{TE}_{ij} + \beta_3 \mathbf{DEV\_WC}_{ij}$$

Where:

$\beta_{0j} = \gamma_{00} + \gamma_{01}\,\mathbf{D}_j + \gamma_{02}\,\mathbf{STU\_S}_j + \gamma_{03}\,\mathbf{SWC} + u_{0j}$

$\beta_{1j} = \gamma_{10}$

$\beta_{2j} = \gamma_{20}$

$\beta_{3j} = \gamma_{30}$

Here, **T, D**, **STU_S**, **TE**, **DEV_WC**, and **SWC** represent the same vectors of variables as in earlier models, and $\gamma_{00}, \gamma_{10}, \gamma_{01}, \gamma_{20}, \gamma_{02},$ and $u_{0j}$ keep the same interpretations from the previous model.

- $\gamma_{30}$ is now the change in the log odds of turnover for a teacher associated with a one unit change in the teacher's deviation from the school mean perception of the working conditions, conditional on the school-level working conditions mean.
- $\gamma_{03}$ is now the change in the school intercept associated with a one unit change in the school mean teacher perception of the working conditions.

I expected that when working conditions and teacher effectiveness were included in the model simultaneously, their associations with turnover would be nearer to zero than when they were evaluated individually. If this held true, the $\gamma_{20}, \gamma_{30}, \gamma_{03},$ would change relative to the parameters for the same variables from earlier models. If the coefficients for both working conditions and teacher effectiveness decreased in strength compared to earlier models, this would indicate that theses variables were endogenous in those models. One explanation for the decrease in magnitude of the coefficient for working conditions would be that effective teachers are sorted into schools with organizational conditions that are perceived as being better. Under the conditions that effectiveness is negatively related to turnover, if more effective teachers rated

working conditions more highly, and if effective teachers are inequitably distributed across schools, than the observed relationship between working conditions and turnover would be partially explained by teacher effectiveness. This could be true for either the teacher's individual perception of the working conditions or the school aggregated version of the variable.

Several possibilities could explain a reduction in the coefficient for teacher effectiveness. The first is that working conditions do contribute to the measure of effectiveness, the VAM score. Another possibility, again, is that effective teachers are sorted into schools with better working conditions. In both cases, without working conditions included in the turnover model, the effectiveness variable would reflect some of the association between working conditions and turnover. There was also the possibility that the coefficients would not change in comparison to the earlier models. This would indicate that the VAM scores are not being biased by the working conditions in the school, and the association between working conditions and turnover is not being biased by the sorting of teacher effectiveness across schools.

*Potential Interaction between Working conditions and Effectiveness*

If working conditions and teacher effectiveness are independently associated with turnover, could the role of working conditions function differently for teachers of differing ability? If so, to what extent is the role of teacher effectiveness in turnover dependent on the working conditions in a school? This interactive relationship has received little, if any, attention in the previous literature on teacher turnover. To explore the potential of an interaction, I added an interaction term to the previous model. I ran one model not conditioning on teacher and school characteristics and one model that did include the control variables. The model with control variables is described below, and took the following form:

$$\log\left(\frac{\pi_{ij}}{1-\pi_{ij}}\right) = \beta_{0j} + \beta_1 \mathbf{T}_{ij} + \beta_2 \mathbf{TE}_{ij} + \beta_3 \mathbf{DEV\_WC}_{ij}$$

Where:

$\beta_{0j} = \gamma_{00} + \gamma_{01}\,\mathbf{D}_j + \gamma_{02}\,\mathbf{STU\_S}_j + \gamma_{03}\,\mathbf{SWC} + u_{0j}$

$\beta_{1j} = \gamma_{10}$

$\beta_{2j} = \gamma_{20} + \gamma_{21}\,\mathbf{SWC}_j$

$\beta_{3j} = \gamma_{30}$

The key difference in the modeling approach here is that now the slopes of the teacher effectiveness variables were modeled as a function of the working conditions at the school level. **T, D**, **STU_S**, **TE**, **DEV_WC**, and **SWC** represent the same vectors of variables as in earlier models, and $\gamma_{00}, \gamma_{10}, \gamma_{01}, \gamma_{02}, \gamma_{30}$ and $u_{0j}$ keep the same interpretations from the previous model.

- $\gamma_{20}$ is now the mean intercept for the teacher effectiveness coefficient at the mean of the working conditions covariates.
- $\gamma_{21}$ is the change in the teacher effectiveness coefficient associated with a one unit change in the school mean teacher perceptions of the working conditions, relative to the mean school mean.

I hypothesized that there would be an interaction between working conditions and teacher effectiveness in their relationship to turnover, and that when working conditions were perceived as being more positive, more effective teachers would be more likely to remain in their schools. The presence of an interaction would be indicated by a significant value for the coefficient on the working conditions predictor for the slope of teacher effectiveness ($\gamma_{21}$). The expectation was for a negative value of the coefficient. This would mean that as school mean working conditions improved, the role of teacher effectiveness in predicting *turnover* would become smaller, and more effective teachers would be less likely to leave. A positive value however, would indicate

that as school working conditions "improved" the slope for teacher effectiveness would *increase*, and more effective teachers would be more likely to leave schools with these "better conditions". This would be an unlikely occurrence given findings from previous work on turnover. A null finding would indicate that the role of teacher effectiveness is not sensitive to working conditions in predicting turnover. While improving working conditions might still reduce turnover overall, there would be no reason to believe that these improvements would necessarily enable schools to retain more effective teachers specifically.

## Summary

This study was designed to uncover the ways in which teacher effectiveness and school working conditions operate together to produce teacher turnover. The analysis leveraged hierarchical linear modeling to explore if and how working conditions variables explain previously observed relationships between teacher effectiveness and teacher turnover and explored the extent to which an interactive effect between these variables was present. Results of the analysis are presented in the next chapter.

# CHAPTER FOUR - RESULTS

School working conditions and teacher effectiveness are both thought to be key factors in teachers' decisions to stay in or leave their schools. Yet cleanly identifying the nature and parameters of their relationships with turnover is complicated. Working conditions are often closely correlated with school student compositions, and teacher effectiveness is often related to a teacher's level of experience. Such interrelationships can result in issues of endogeneity when the correct set of variables are not controlled for in analytical models. The fact that measures of teacher effectiveness, specifically value-added model scores, do not often control for the social and organizational factors, which may themselves contribute to student learning, further complicates the issue. Models of effectiveness and turnover therefore run the risk of misstating the relationship between these variables if the school working conditions are not considered. This chapter addresses these issues and helps to clarify our understanding of teacher turnover by directly investigating the research gaps and methodological issues discussed in chapter two, and by providing the results of the analysis described in chapter three.

## Teacher Characteristics

As discussed earlier, the sample of teachers who participated in the MET do not constitute a randomly drawn sample from the population of American teachers. For this reason, caution should be exercised when generalizing the relationships identified in this chapter to teachers beyond those who participated in the MET. Nevertheless, the MET sample of teachers offers one of the best opportunities to investigate the research questions that motivate this

dissertation, as few other datasets allow for the opportunity to link working conditions and teacher effectiveness data.

Table 3 presents descriptive statistics on the teachers who were included in the analysis. The final analytical sample included 1,154 teachers from 148 different schools, with an average of 7.80 teachers responding per school. Of the teachers, 285 (24.70%) were no longer teaching in the same school during the second year of the study. These teachers are considered to have left their school or to have "turned over."

Descriptive statistics on teacher characteristics, with breakdowns by turnover outcome, are presented in Table 4. The sample was predominantly comprised of White, female teachers. Of the teachers, 17.16 % were male, 65.42 % were White, 27.30 % were Black, 5.37 % were Hispanic, and 1.91 % were included in a different race category. Teachers in the sample taught in grades 4-9, with 37.26 percent teaching in elementary grades and 62.74 percent teaching in middle school and high school grades. New teachers, or teachers in their first three years of teaching, comprised 19.24 % of the sample, with 222 total teachers. In terms of subject area specializations, the sample included 277 (24.00%) generalist teachers, who taught both English and Math, 463 (40.12%) ELA teachers, and 414 (35.88%) math teachers. The mean VAM score for teachers in the sample was 0.00 with a standard deviation of 0.30. Most teachers (73.05%) taught in predominantly minority schools.

Comparing teachers who left their jobs to teachers who stayed resulted in several distinctions between the groups. Leaving teachers tended to be comprised of higher proportions of females (84.56% amongst leavers vs 82.28% amongst stayers), White teachers (67.72% vs 64.67%), new teachers (24.56% vs 17.49%), elementary school level teachers (41.75% vs

35.79%), and ELA (42.81% vs 39.24%) and generalist teachers (28.77% vs 22.44%). Overall, as demonstrated in the correlation matrix presented in Table 5, these teacher characteristics were not strongly correlated with the turnover outcome, and none of the individual teacher characteristics shared a correlation coefficient with turnover that reached above an absolute value of 0.1. The strongest associations were found among new teacher status and turnover (r=0.08), with new teacher status being positively related to turnover, and with math teacher status and turnover (r=-0.09), which had a negative relationship. Leaving teachers were more likely to work in predominantly minority schools, with 82.46% of leaving teachers working in predominantly minority schools compared to 69.97% amongst staying teachers. Interestingly, teacher experience was not equitably distributed across school type. Teacher characteristics by school type are presented in Table 6. While predominantly White schools were comprised of 13.83% new teachers, predominantly minority schools were comprised of 21.23% new teachers.

## Baseline Models

Baseline regression models are presented in Table 7. Results from the analysis indicated that school-level characteristics appear to play a role in teacher turnover decisions. A baseline hierarchical model was run to determine the amount of between school variability that existed in the turnover outcome when not including any of the key covariates in the analysis. This intercept model (Model 1), which included district dummy variables indicated the presence of between school variability in the expected probability of turnover in each school, with a calculated $\tau 00$ of 0.34 and an intra-class correlation of 9.35%. In other words, after accounting for teachers'

districts, approximately 9.35% of the variability in turnover could be attributed to differences between schools[5].

The second model described the ways in which individual teacher characteristics were associated with turnover. Consistent with findings from previous research (Johnson et al., 2005; and Guarino et al., 2006), new teachers in the MET sample were more likely to leave their schools than more experienced teachers. The odds of turnover increased by a statistically significant 73% (SE = 0.31, $p<.01$) for new teachers relative to more experienced teachers, other factors held constant. The model also indicated that Black teachers were less likely to turn over than White teachers, with odds decreasing by a factor of 0.69 (SE = 0.14, $p<.1$), all else equal. Statistically significant odds ratios were not found for the role of gender, grade level, or subject area focus when conditioning on the other teacher characteristics.

Baseline relationships between school-level student characteristics and turnover were then established. Descriptive statistics on school-level characteristics are presented in Table 8. The average school had a mean student z score on the prior year's state administered ELA exam of 0.07 and a mean teacher working conditions survey scale score of 50.20. Turnover rates were on average lower in schools with higher performing students, with a correlation coefficient of -0.08 between prior achievement and turnover, as indicated earlier in Table 5. Results (presented earlier in Table 6) also indicated a higher base turnover rate for teachers working in predominantly minority schools of 27.88%, relative to the 16.08% turnover rate in predominantly White schools. Correlation coefficients for the school-level variables, presented in

[5] A likelihood ratio test conducted on this null model also indicated that the multi-level form of the model was statistically significantly dissimilar from a single level model indicating the presence of substantive between school variance in the turnover outcome. These findings justified proceeding with a multi-level framework for the subsequent regression models.

Table 9, also indicated that predominantly minority schools also tended to have lower average prior achievement scores (r = -0.54).

Regression models (Table 7) then established the relationships between these school composition characteristics and teachers' odds of turnover. Model 3 presents the results of the calculations for school student race compositions. Relative to teachers in predominantly White schools, teachers in predominantly minority schools had odds of turnover that were higher by a factor of 2.04. This difference was statistically significant with a p value of <.01 (SE=0.47). For the mean teacher, this difference corresponded with a 12.69 percentage point increase in the probability of turnover when working in a predominantly minority school compared to a predominantly White school.

The base relationship between school-level prior achievement and turnover, in the absence of other school characteristics was then established in Model 4. Results indicated that for a one unit increase in the school mean student test z score from the prior year, the odds that a teacher would turnover decreased by a factor of 0. 59, a statistically significant value (SE = 0.14, p<.05). Once the student racial composition variable was re-entered into the model (Model 5), however, the relationship between prior achievement and turnover was no longer statistically significant. This suggests that observed higher rates of turnover for teachers working in schools with lower achieving students may be more closely tied to factors of race rather than of student achievement, as schools with lower achieving students tend to be more predominantly minority. Together, these combined school-level student composition variables accounted for some of the between school variance in turnover identified in Model 1, with a reduction in the intraclass correlation from 0.09 to 0.08. The relatively small magnitude of the reduction, however,

indicated that some school-level factors related to teacher turnover decisions had yet to be accounted for.

The next step in the analysis was to combine the school-level student demographic characteristics with the teacher demographic variables to determine whether any of the previous associations with turnover from previous models would be changed in the presence of a broader set of control invariables, and to establish a baseline of comparison for use against the main analytical models. This model (Model 6) replicated the identified associations from the earlier models. Black teachers were found to be less likely to leave their schools than their white counterparts, and new teachers were found to be more likely to leave than more experienced teachers. Notably, once school-level student demographic characteristics were accounted for, the odds ratio for new teacher status decreased from 1.73 (Model 2) to 1.61, indicating that in the earlier model new teacher status had been partially capturing the association between student composition and turnover. In the combined model, school student racial composition continued to demonstrate a statistically significant association with turnover, with greater probabilities of teachers leaving being associated with predominantly minority schools. Once teacher characteristics and student achievement were accounted for, the odds of turnover for a teacher in a predominantly minority school were still 181% higher than the odds for a teacher in a predominantly White school. These findings partially motivated the next stage of the analysis.

## Research Question 1 – Working Conditions and Turnover

The next part of the analysis sought to determine the ways in which school working conditions were related to teacher turnover decisions, the extent to which they accounted for between school variation, and whether working conditions explained the observed higher rates of turnover in predominantly minority schools.

Leaving teachers had lower overall mean perceptions of the working conditions in their schools (47.88 vs 51.02) on the raw score of the composite variable. Distributions of teacher responses on the raw score composite variable, for all teachers and broken down by outcome, are presented in Figure 3. The distributions visually demonstrate the differences in responses between teacher based on outcome. For instance, staying teachers had a higher concentration of responses above a value of 60 than did leaving teachers, whereas leaving teachers had a higher concentration of responses below a score of 40.

As described in the last chapter, the teacher raw score variable was also deconstructed into a school mean component and a teacher deviation component. On average, for both components of the variable, teachers who left the school had lower values than teachers who remained, with a mean of 49.08 (sd =4.15) for leavers on the school mean component, compared to 50.61 (sd = 4.55) for stayers, and a mean of -1.20 (sd = 5.84) for leavers on the deviation component, compared to 0.41 (sd = 7.20) for stayers (as reported in Table 4).

Regression models established the base relationships between the different working conditions variables and turnover, not controlling for other factors. Results are presented in Table 10. Overall, these models demonstrated that teacher turnover decisions appear to be consistently linked to their appraisal of the work place. The first working conditions model established the role of the non-decomposed raw teacher scale score of the working conditions

composite variable in predicting turnover. Results indicated a statistically significant negative relationship between teachers' perceptions of the organizational conditions in their schools, and the likelihood that they would leave. For each one unit increase in the teachers' scale scores their odds of leaving decreased by a factor of 0.93 (SE= 0.01, p<.01). When evaluated for the mean teacher, this difference translated to a 1.12 percentage point reduction in the probability of turnover for each one-point increase in a teacher's perception of the working conditions in the school.

The next two models then focused on the decomposed elements that constitute the teacher composite scale score; the school mean teacher perceptions of the working conditions and the individual teacher's deviation from that mean. The mean teacher perception of the working conditions in the school had a statistically significant negative association with turnover, with a one unit increase being associated with a decrease in the odds of turnover by a factor of 0.91 (SE = 0.02, p<.01). When evaluated for the mean teacher this meant that for each one unit increase in the school mean teacher perception of the work environment, the probability that a teacher would leave their job decreased by 1.73 percentage points. This suggests that turnover may not only be tied to the individual's perception of the work environment, but that turnover may also be a function of the shared and commonly experienced characteristics of the workplace.

Focusing then on the teacher specific component of the working conditions composite variable, or deviation score, the model indicated that for a one unit increase in the teachers' deviation from the mean perception of the other teachers in the school, the odds that they would turnover decreased by a factor of 0.95. This change was statistically significant with a p-value of <.01 and translated to a reduction in the probability of turnover by 0.95 percentage points when

evaluated for the mean teacher. This suggests that along with the organizational level school working conditions, teachers' own perceptions of those conditions, and specifically the extent to which they differ from the other teachers in the same school are important in their career decisions. In other words, whatever the mean perception of the teachers in the school overall, having an individual perception of that environment that is different from that of the other teachers is in itself associated with teacher turnover decisions. The more teachers positively deviate from the perceptions of the other teachers in their school, the more likely it is that they will opt to continue teaching there.

The next model introduced the contextual effects framework. In this model teacher deviations from the school mean perception of working conditions were included at the same time as the school mean teacher perception. This setup allows for a determination of whether the school working conditions continue to have an association with turnover even after accounting for the individual teacher perception, in the form of teachers' deviation from the school mean perception. Results indicated that for a one unit increase in the teachers' deviation the odds of turnover decreased by a factor of 0.95, which was statistically significant with a p-value of <.01 and translated to a reduction in the probability of turnover by 0.97 percentage points when evaluated for the mean teacher. In the model, the school mean perception of working conditions was also found to be statistically significantly negatively associated with turnover. For a one unit increase in school mean working conditions the odds of turnover decreased by a factor of 0.90, with a p-value of <.01. This translated to a 1.76 percentage point decrease in the probability of turnover for each one unit increase in school mean perceptions of working conditions when evaluated at the mean of the included variables. The statistically significant finding for both the teacher deviation value and the school mean value of working conditions underline the

importance of working conditions in the turnover process. Teacher turnover decisions appear to be both a function of the way in which the individual teacher experiences their school and of the way in which the school is perceived by the teachers overall. In other words, organizational conditions appear to have a role in turnover that extends beyond the individual idiosyncrasies in the way teachers perceive the school environment.

If school working conditions are associated with teachers' decisions about whether they will stay in their schools, to what extent might these working conditions help explain the observed patterns of turnover associated with student racial compositions from the earlier models? Could it be possible that teachers appear to be more likely to leave predominantly minority schools simply because such schools also tend to have worse working conditions? Descriptive statistics, presented earlier in Table 6, suggested that, overall, teachers working in predominantly minority schools viewed their working conditions as being worse than teachers in predominantly White schools. The mean teacher raw score on the working conditions composite variable was 53.79 in predominantly White schools, but only 48.93 in predominantly minority schools. Histograms depicting the differences in distributions of teacher raw score values on the working conditions composite variable are presented in Figure 4. Corresponding with the descriptive statistics, these histograms demonstrate a higher concentration of teachers reporting lower perceptions of the workplace in predominantly minority schools, with the most noticeable differences occurring in the tails of the two distributions. Teachers in predominantly minority schools, for instance, have a greater concentration of values below a score of 40 compared to teachers in predominantly White schools.

The next set of models, presented in Table 11, sought to shed light on the extent to which these relationships resulted in inaccurate estimations of the role of school student race

characteristics in predicting turnover. As a first step in this stage of the analysis, the teacher raw scale score on the working conditions composite was included along with the teacher demographic variables and school student composition variables in Model 1. Consistent with previous research (Boyd et al, 2011; Johnson et al., 2012; Ladd, 2011), the results from the model indicated that when working conditions were accounted for, the observed relationship between school student race composition and turnover was substantively reduced from the comparison model (Table 7, Model 6). The odds ratio associated with working in a predominantly minority school compared to a predominantly White school decreased from 1.81 to 1.51 and was no longer statistically significant. These findings indicate that while higher rates of turnover are observed for teachers working in predominantly minority schools, teachers are not actually leaving those schools because of their students. Poorer working conditions, which happen to be more common in predominantly minority schools, may instead be the true reason for the increased departure rates for teachers in these schools[6].

Turning to the models that decomposed the teacher scale scores into the school mean component and teacher deviation component further shed light on the mechanism through which the working conditions explained the relationship between student composition and turnover. The model including only the school mean component with the other control variables (Model 2) yielded comparable results in terms of a reduction in the observed coefficients for the student race variables. Here the odds ratio for the predominantly minority school variable decreased from 1.81 to 1.37. Conversely, in the model that included only the teacher deviation from the mean of the other teachers in the school (Model 3), the odds ratios for the predominantly

[6] To determine whether the role of teacher perceptions of the working conditions was dependent up teacher level of experience, a model was run which included an interaction term for the teacher raw score on the working conditions composite variable and new teacher status. The interaction term was not found to be statistically significant.

minority variable remained largely unchanged. These findings suggest that while the extent to which teachers deviate from the mean perception of teachers in their school is predictive of the teachers' career decisions, these individual components of teacher perception alone do not account for the observed relationship between school student composition and turnover. This is not surprising, as the teacher deviations scores are, by definition, independent of the working conditions school mean values, and therefore with the correlated school-level student composition characteristics.

The importance of the different working conditions variables are also demonstrated visually with predicted probability curves. These curves indicate the probability of turnover associated with different values of the working conditions variables, conditional on the other teacher and school demographics, and are presented in Figure 5. Decreasing probabilities associated increasing values of the working conditions variables are clearly demonstrated for each operationalization of the working conditions variables. The curves further indicate that greater changes in probabilities occur for one unit changes at the lower ends of the working conditions variables. In other words, changing the perceptions of the working conditions for teachers who have low perceptions of the workplace may have a greater impact on the probability than equivalent changes for teachers who already perceive their work environment as being positive. Teachers in schools with poorer working conditions may be more sensitive to the working conditions in their schools, a finding consistent with previous research (Johnson et. al. 2012).

Returning to the contextual effects framework in Model 4, even in the presence of the teacher demographic and school student composition control variables, both components of the working conditions composite variable retain a statistically significant negative association with

turnover. In this model, the presence of the working conditions variables were also associated with a reduction in the coefficients for the predominantly minority school variable, which decreased from 1.81 to 1.36. Furthermore, once the working conditions variables were included with the other teacher and school variables, the intraclass correlation decreased from 0.07 in the reference model to 0.05, indicating that the working conditions variables are successfully accounting for some, though not all, of the between school variation in turnover outcomes.

If working conditions are related to teacher turnover decisions, are there some features of the work environment that are more important than others in reducing turnover? Descriptive statistics for the individual working conditions scales, for the raw and contextual effects forms, are presented in Table 12. For each scale, and within each specification used, leaving teachers had lower mean values in their responses than teachers who did not leave their schools. Correlational analysis also demonstrated moderate to strong relationships amongst the variables. For the teacher raw score values the weakest correlation between the working conditions scales was found between the Time and Community Support scales (r =0.39), while the strongest was found between Teacher Leadership and School Leadership (r = 0.78). This pattern was similarly demonstrated for the school mean specification, as presented earlier in Table 9[7].

To develop more understanding about the individual components of the working conditions composite variable, contextual effects regression models with teacher and school control variables were run for each of the working conditions scales measured by the MET teacher climate survey. Results from these models are presented in Table 13 and 14. To account for the use of multiple analyses being run on scales with then school mean working conditions and teacher deviation score domains, the Benjamini-Hochberg (B-H) (1995) procedure was used

[7] A similar patter was also evident in the teacher deviation scores, as indicated in the correlation matrix presented in Appendix B.

to adjust critical p-values for each of the variables. Results for the procedure are presented in Table 15. None of the inferences discussed below for the working conditions variables were changed after the adjustments.

In most cases, both the school mean variable for the working condition and the teachers' deviation from the mean perception of the other teachers in the school for the working condition, were statistically significantly negatively related to the probability of turnover. Regarding teachers' perceptions that they had sufficient time to plan and to teach (Time), for a one unit increase in the school mean value, the odds that a teacher would turnover decreased by a factor of 0.93 (SE = 0.02, p<.01), which translated to a decrease in the probability of turnover by 1.15 percentage points for the average teacher. For a one unit increase in the teacher's deviation from the other teachers, the odds that a teacher would turnover decreased by a factor of 0.96 (SE=0.01, P<.01), which translated to a 0.72 percentage point decrease in the probability of turnover for the average teacher. Along with having sufficient time, the physical and material characteristics of the school also appeared to matter. For teachers' perceptions of school facilities and the resources available (Resources) a one unit increase in the school mean value was associated with a decrease in the odds of turnover by a factor of 0.94 (SE= 0.02, p<.01), while for a one unit increase in the teacher's deviation the odds decreased by a factor of 0.97 (SE = 0.01, p<.01). These differences translated to a 1.10 percentage point decrease in the probability of turnover for the school mean value, and a 0.56 percentage point decrease for a one unit change in the deviation value for the average teacher. Similar associations were found for teachers' positive perceptions of the overall student behavior in the school (Student Conduct). A one unit increase in the school mean value was associated with a reduction in the odds of turnover by a factor of 0.94 (SE=0.02, p<.01), while a one unit increase in the teachers' deviation score was associated

with a reduction by a factor of 0.97 (SE = 0.01, p<.01). In terms of changes to the probability that a teacher would leave their school, these values translated to a 1.15 percentage point decrease for the school mean value, and a 0.59 percentage point decrease in the case of the teachers' deviation from the perception of the other teachers in the school.

For the two scales most directly related to leadership practices in the school, negative associations with turnover were found for both the school mean values and the teacher deviation scores. In the case of the Teacher Leadership scale, a reflection of the amount of teacher autonomy and influence in the school, a one unit increase in the school mean value was associated with a reduction on the odds of turnover by a factor of 0.94 (SE=0.02, p<.01) and a one unit increase in the teachers' deviation score was associated with a reduction in the odds of turnover by a factor of 0.97 (SE= 0.01, p<.01). These differences in odds translated to reductions in the probability of 1.10 percentage points for a unit increase in the school mean value, and 0.52 percentage points for a unit increase in the deviation value, for the average teacher. Turning to the School Leadership scale, a reflection of the way in which teachers perceived the quality of the principals and administrators in their school, for each one unit increase in the school mean the odds that a teacher would leave their school decreased by a factor of 0.93 (SE = 0.02, p<.01), meaning that for the average teacher the probability of turnover was reduced by 1.32 percentage points. Similarly, for each one unit increase in the teacher's deviation from that mean, the odds of turnover were reduced by a factor of 0.95 (SE =0.01, p<.01), translating to a 0.80 percentage point decrease in the probability of turnover for the average teacher.

Along with leadership, the quality of the Professional Development (PD) opportunities delivered to teachers had a negative association with turnover. When the school mean teacher perception of PD increased by one unit, the odds that a teacher would turnover decreased by a

factor of 0.93 (SE=0.02, p<.01), equivalent to a 1.12 percentage point decrease in the probability of turnover for the average teacher. For a one unit increase in the teacher's deviation from the mean of the perceptions of the other teachers, the odds of turnover decreased by a factor of 0.98 (SE=0.01, p<.01), though this was associated with only a 0.43 percentage point decrease in the probability of turnover for the mean teacher.

Not all the working conditions elements were found to have statistically significant negative associations with turnover at both the school level and the individual teacher level. In the case of the Community Support scale, which indicated how teachers felt about the quality of school and community connections, neither the school mean value nor the teacher deviation value had a statistically significant relationship with teacher turnover decisions at the p <.05 level. In the case of the Instructional Practice and Support scale, reflective of items relating to how innovative teachers in the school are, and how teachers perceive the capabilities of the teachers and students in their school, only the school mean value had a statistically significant association with turnover. For this aspect of the scale, a one unit increase in the value was associated with a reduction in the odds of turnover by a factor of 0.91 (SE=0.02, p<.01), translating to a 1.70 percentage point decrease in the probability of turnover for the mean teacher.

The different working conditions variables were also differentially associated with the racial composition of the students in the schools, as demonstrated earlier in Table 9. Therefore, excluding some of the working conditions variables from a turnover model could have different implications for the estimation of the student race coefficients. To determine whether some of the scales were better at explaining the relationships between student race and turnover, the

extent of the reduction in the coefficients for the race variables relative to the model which did not include any working conditions were compared.

Relative to the baseline model, in which the odds ratio for turnover associated with a teacher being in a predominantly minority school relative to a White school was 1.81, the greatest reduction in the odds ratio occurred with the Instructional Practice and Support scale. In this model the odds ratio was only 1.33. Including the Student Conduct Management scale in the model also resulted in a considerable decrease to 1.44 for the odds ratio for the predominantly minority variable. In contrast, when the Teacher Leadership scale was entered in the model the odds ratio for the predominantly minority variable decreased to only 1.62, indicating that this organizational factor did the least to explain the observed relationship between school racial composition and turnover. Together, these findings indicate that there is considerable variation in the intercorrelations between different working conditions, school racial compositions, and turnover. Teachers who leave schools with higher concentrations of minority students may be responding more to the poorer conditions related to Instructional Practice and Support, and Student Conduct, than they are to other factors, like Teacher Leadership.

Knowing how teachers perceive the organizational conditions within their schools does not give a clear indication of whether the teachers are good at their jobs, or of which teachers are leaving in terms of the ability to produce student learning gains. The next stage in the analysis sought to investigate these relationships by looking specifically at the role of teacher effectiveness in turnover.

### Research Question 2 – Teacher Effectiveness and Teacher Turnover

When turnover occurs, is it the most effective teachers who are leaving? Rational actor theory suggests that more effective teachers may be more likely to leave their schools to pursue

better options elsewhere. Another possibility is that more effective teachers may be more likely to stay in their schools because of the psychic rewards afforded by their effective practice. The next part of the analysis aimed to shed light on the relationship between effectiveness and turnover by modeling how teacher VAM scores were predictive of turnover outcomes in the MET sample of teachers.

On average, leaving teachers and staying teachers had relatively similar VAM scores, with leaving teachers having a mean VAM score of 0.02 (sd = 0.31) and staying teachers having a mean VAM score of 0.00 (sd = 0.30), as reported earlier in Table 4. These differences in means corresponded with a small positive correlation between VAM score and the turnover outcome (r=0.03). Regression coefficients for the VAM score models are presented in Table 16. The base relationship between VAM score and turnover, in the absence of control variables, was established in Model 23. This model indicated that for a one unit increase, or slightly more than three standard deviations, in teacher VAM score (sd=0.30), the odds that a teacher would turnover *increased* by a factor of 1.20. For teachers at the mean of the variable, this difference translated to a 3.27 percentage point increase in the probability of turnover. This value, however, was not found to be statistically significant even at the p = .10 level. This finding indicates that the null hypothesis of no association between VAM score and turnover cannot be rejected. The MET sample of teachers does not provide confirmatory evidence for either the rational actor model, or for a model suggesting that more effective teachers would be more likely to stay[8].

[8] One possible explanation for this finding was that a U-shape relationship exists between VAM score and turnover, in which teachers with lower VAM score and teachers with higher VAM scores would *both* be more likely to turnover than teachers with VAM scores closer to the average. To test this possibility a regression model was run in which VAM score was treated as a categorical variable, with the levels representing the lowest, middle, and higher third of teachers in terms of VAM score. While probabilities of turnover were higher for teachers with the lowest and highest VAM score, relative to the middle group, the differences were not statistically significant.

This inference was unchanged even when accounting for teacher demographic characteristics and school composition characteristics in Model 24. Here the results from the model indicated that for a one unit increase in teacher VAM score the odds that the teacher would turnover increased by a factor of 1.27. While this association was stronger than that found in the model with no control variables, the value was still not statistically significant.

Because teaching experience is a consistent predictor of teacher effectiveness (Goe 2007, Rice, 2003; Wilson and Floden, 2003) and because VAM score was negatively associated with new teacher status in the MET, with a correlation coefficient of -0.05, it could have been possible that the relationship between VAM and turnover was being understated in models that did not account for teacher experience, or that the role of experience was being understated in models that did not include the teacher effectiveness variable. The regression analysis indicated that accounting for VAM score along with the teacher demographics resulted in only a slight change to the coefficient for new teacher status, which became stronger in the more complete model, increasing from an odds ratio of 1.61 in Model 6 to 1.62. Relative to the model without the new teacher variable, the coefficient for VAM score also increased[9]. As discussed, this change did not result in a statistically significant finding for the VAM coefficient.

## Research Question 3 – The Relationship between Working Conditions and Teacher Effectiveness

Having schools that are organized to perform well, or that are prepared to "activate the mechanism" of teachers, is often thought to be a precursor of teacher effectiveness. If this is the

[9] A model assessing the potential of an interactive effect between VAM score and level of experience was run to determine whether the role of effectiveness in turnover might be dependent on experience. The interaction term was not found to be statistically significant.

case, we might expect that measurements of teacher effectiveness in the form of VAM scores are partially capturing school effects when they do not include controls for school working conditions. If VAM score calculations do not account for working conditions, could there be implications for the calculation of coefficients describing the relationship between VAM and turnover? Might it be possible that the role of VAM in turnover is being systematically overstated or understated because of shared relationships between VAM score and working conditions? These concerns motivated the next segment of the analysis. Working conditions and teacher VAM scores share a complex, though not particularly strong, relationship in the MET sample of teachers. While school mean working condition scale scores are positively correlated with VAM scores ($r = 0.04$), the extent to which teachers deviate in their perceptions of the workplace is negatively correlated with VAM score ($r=-0.07$)[10]. This suggests a small tendency for schools with better working conditions to have more effective teachers, and, within schools, for more effective teachers to have lower perceptions of the workplace. Scatter plots depicting the relationships between VAM scores and the different working conditions variables are presented in Figure 6. These plots demonstrate visually that while there is a slight tendency for teachers with higher school mean working conditions values to have higher VAM scores, and for teachers with higher deviations scores to have lower VAM scores, these relationships are not strong or consistent across all teachers.

Several regression models were run to determine whether the coefficient for VAM in the turnover outcome model changed in the presence of the different working conditions variables. Results from the models are presented in Table 17. Results from Model 1 indicated when the teacher raw score variable was included in the model, the coefficient for the VAM score

[10] Correlation coefficients reported in Tables 19-22 in Appendix B

decreased from 1.27 to 1.21, and no changes were in the inferences made about statistical significance for either teacher effectiveness or teacher perceptions of working conditions. The next two models then focused on the decomposed elements of the teacher raw score. Model 2 presents the results for when the school mean perceptions of working conditions were included with VAM score. In this model the odds ratio associated with VAM score *increased* from 1.27 to 1.31. The change in the VAM coefficient was not so extreme as to result in a change in inference regarding the null finding of the statistical significance of the variable. This suggests that amongst the MET sample of teachers, because teachers with higher VAM scores tend to teach in schools with better working conditions, not accounting for working conditions can lead to an underestimation in the association between VAM score and turnover. This relationship may not hold true for a broader population of teachers, however.

Model 3 then substituted the teacher deviation scores for the school mean value, to determine the extent to which individual perceptions of working conditions behaved differently than organizational level factors in regard to changes in the VAM coefficient. Compared to the model excluding working conditions, the coefficient for VAM score decreased from 1.27 to 1.20 once teacher deviation scores were accounted for. This suggests that, amongst the MET teachers, because teachers with higher VAM scores tend to view the working conditions in their schools as being more negative, relative to the other teachers in the same school, not accounting for the individual teacher perception of the workplace may result in an overestimation of the role of VAM in turnover. Taken together, the results from Models 2 and 3 indicate that to accurately calculate the strength of the association between VAM score and turnover, working conditions at both the organizational level and at the individual level may need to be included in the analytical models of turnover. Following this logic, the working conditions variables from the contextual

effects framework, which included the school mean value and the teacher deviation values, were then included along with the teacher VAM scores in model 4. With the working conditions variables included in the model, the coefficient for teacher effectiveness was reduced slightly from the model without working conditions. A one unit increase in teacher VAM score was now associated with an increase in the odds of turnover by a factor of 1.25 rather than 1.27. As before, this association was not large enough to constitute a statistically significant value. The reduction in the size of the odds ratio further suggests, however, that working conditions and VAM scores are not independent of one another in their relationship to turnover for the MET sample of teachers. Further research will be required to determine the extent to which these relationships are also operant for broader populations of teachers.

### Research Question 4 – Assessing the Possibility of an Interaction.

The final stage of the analysis investigated whether the role of teacher effectiveness in predicting turnover might be contingent upon the working conditions in the school. If working conditions have a negative relationship with turnover, could their influence be even stronger for more effective teachers? To determine if this might be the case, an interaction term for school mean working conditions and teacher VAM score was included along with the contextual effects framework variables for working conditions and the teacher VAM score in models 1 and 2, reported in Table 18. The interaction term took a negative value of 0.98 in the odds ratio form when accounting for other school and teacher variables in Model 30 but was not found to be statistically significant. The negative sign on the interaction term, however, suggests that in the MET sample of teachers, for teachers in schools with more positive working conditions, the positive relationship between VAM and turnover is dampened. In other words, amongst the MET

sample, for two teachers with equivalent VAM scores, one teaching in a school with better working conditions would be less likely to turnover than would be expected by the difference in working conditions alone. More effective teachers may be deriving more value from the positive environment than less effective teachers and may therefore be more inclined to stay. Again, determining whether such a relationship might be present in a broader population of teacher would require more research.

# CHAPTER 5 - DISCUSSION

Teacher turnover presents a challenge to educational equity. Turnover, which carries financial and academic costs for schools and students, occurs disproportionately in schools serving higher concentrations of minority and poor students. Yet the full picture of which factors lead to a teacher's decision to leave their job is still emerging, and the most appropriate responses to turnover are still being determined. This study contributes to the work being done to remedy the teacher turnover problem by bridging two concepts that have up till now only been studied independently of one another; school working conditions and teacher effectiveness. These factors were purposely drawn together in analytical models of teacher turnover to discover whether the inferences made about them individually would change once both were accounted for simultaneously. This approach was made possible by the utilization of the Measures of Effective Teaching dataset, which possessed the rare quality of having linkable data on teacher turnover outcomes, teacher perceptions of their work environment, and teacher value-added model scores.

The main findings from the study were clear and consistent. First, and unsurprisingly, working conditions are strongly tied to turnover. At both the school level, and at the level of the individual teacher, the more positively the teachers view the social and organizational conditions of their schools, the less likely it is that they will leave. Additionally, because of the inequitable distribution of school organizational quality across student populations, accounting for working conditions helps to explain why teachers working in predominantly minority schools have higher rates of turnover than teachers in predominantly White schools. The second main finding was that neither more effective nor less effective teachers appear to be leaving their schools at higher rates. Teacher value-added model scores, as operationalized

by the MET, are not predictive of turnover. Finally, teacher effectiveness, and school working conditions share a complex relationship which warrants further investigation among different populations of teachers. While schools with better working conditions tend slightly to have more effective teachers, within schools more effective teachers may have lower perceptions of their working conditions than their peers. Largely, however, accounting for school working conditions does not change the inference made about the absence of a relationship between VAM scores and turnover.

## School Working Conditions

While previous research has lent considerable evidence to the claim that working conditions matter to teachers, few, if any, studies have attempted to account simultaneously for both a school-level and an individual level conceptualization of working conditions. This study leveraged a contextual effects framework, in which both school mean teacher perceptions of their working conditions, and teacher deviations from those means, were analyzed in the same models. Additionally, this study utilized a multi-level modeling approach, treating teachers as being nested within schools, which has only rarely been employed in past turnover research (Strunk & Robinson, 2006).

Analysis of the working conditions variables indicated that both school mean working conditions and individual teacher deviations were negatively associated with turnover. Teachers who work in schools with better working conditions are less likely to turn over than otherwise similar teachers working in schools that are not perceived as being as good. The extent to which teachers diverge from other teachers in the same school in their perceptions of the work

environment is also related to turnover. In schools with the same working conditions, teachers who view the work environment as being more positive than their peers are less likely to leave.

Together, these findings suggest that teacher career decisions are a function of both the organizational features of a school, which are common to all the teachers working there, the individual characteristics of teachers and the ways in which they experience the school environment on an individual basis, and the extent to which teachers are dissimilar from the other teachers in the same school. While a teacher's deviation score is not a direct measure of how well the teacher's values, and teaching approaches "fit" those of the organization, the deviation does provide an indicator of one component of fit; how much teachers share a common perspective on the realities of their teaching environments.

Given these findings, efforts to reduce the amount of turnover in schools should focus both on the organizational conditions within schools, but also on factors which may contribute to how teachers experience those conditions on an individual level. These factors, which shape individual responses to the school environment, may include such things as teacher personality, dispositions, or other attributes. In other words, efforts to reduce the amount of turnover experienced in schools may benefit from a dual pronged approach. Administrators should strive to make meaningful improvements to the organizational quality of their school that will impact the work and teaching experiences of the entire staff. At the same time, these administrators may benefit from working one-on-one with individual teachers who have more negative opinions about the working conditions than their peers, to gauge the reasons behind their impression of the working conditions and assess how best to make changes that reflect these teacher concerns. Interestingly, improvements to the overall working conditions in schools that may result from changing administrations, implementation of different curricula, of different approaches to

instructional expectations, may change the deviation scores that are calculated for individual teachers. Teachers who one had high deviation scores would then have lower deviation scores if the other teachers in the school began to share a more positive opinion of the environment. Because the increase probability associated with a lower deviation score would be offset by the increase in the school mean perspective, making these changes at an organizational level would still be worthwhile.

Making meaningful changes to school working environments should also be part of a broader strategy of achieving educational equity, especially as it concerns turnover. The analysis demonstrated that working conditions in schools help to account the higher levels of turnover occurring in schools with higher proportions of minority students. Once working conditions were included in the turnover models, the relationship between school student race composition and turnover was no longer found to be statistically significant. These findings support those from earlier studies (Johnson et. al. 2012; Ladd, 2011) suggesting that it is not necessarily the students in high minority schools that teachers are choosing to leave but rather the poor working conditions that tend to be associated with those schools.

Unfortunately, this study does not allow for causal attributions to be made about the relationship between working conditions and turnover. Looking at how specific working conditions scales performed in turnover models, however, did shed light on which working conditions variables may be less strongly associated with turnover than the others. Analysis of the individual working conditions also provided the opportunity to determine whether some organizational features were better at explaining the relationship between student race composition and turnover than others.

Of the different working conditions evaluated, only the Community Support scale was found to not be related to turnover at either the school level or the level of the individual teacher. One possible explanation is that aspects of the school organization which may be more directly tied to everyday teaching experiences may be more important than those which have less of an influence. To the extent that school leadership, teacher autonomy, and having sufficient time to teach, may have a closer relationship to what teachers actually do in the classroom, these aspects of teaching may be more important than how involved parents, family members, and legal guardians are in the education of their children. Additionally, different features of Community Support may be differentially related to teacher career decisions. For instance, while teachers may find it beneficial for parents to help students with their homework, or to in other ways supplement the learning that occurs in schools with activities designed to promote learning at home, teachers may find parental input in in-school teacher practice to be bothersome. Too much of that kind of community involvement therefore might be positively, rather than negatively, associated with turnover.

In the case of the Instructional Practice and Support scale, the school mean teacher perception was found to be associated with turnover while the individual teacher's deviation from the school mean was not. This scale was reflective of several aspects of the school environment and teaching practice, including how innovative teachers perceive the other teachers as being, and how much teachers used data to inform instruction. The null finding for the teacher deviation value suggests that on an individual basis, teachers are not as responsive to these elements of the school when deciding to stay or leave. Encouraging data use and innovation in schools may still be useful in efforts to reduce turnover, as working in schools that were higher on the scale continued to have a negative relationship with the outcome.

The analysis of the individual working conditions scales also indicated that different working conditions play different roles in terms of explaining the higher probabilities of turnover for teachers in schools with higher proportions of minority students. The greatest reduction in the coefficient for predominantly minority variable occurred when the Instructional Practice and Support variables were included in the model. Teachers in predominantly minority schools may feel that they do not have access to the data that would help them improve their instruction, or that they are not otherwise given the supports they need to enhance their teaching. Policies geared towards providing teachers with the data and instructional resources they feel they need to deliver the best possible instruction to students may therefore be particularly valuable in efforts to reduce turnover in predominantly minority schools.

Importantly, while working conditions did explain a large portion on the variation in turnover that occurred in the MET schools, not all of the between school variation was fully accounted for. The case may be that there are working conditions not captured by the MET teacher survey that may still be important to teacher career decisions, such as degrees of teacher collegiality in schools or the extent to which teachers feels like members of a community amongst their peers. Another possibility is that school level factors that might not be defined as working conditions, but are still related to turnover, were not captured in the analysis. These might include such factors as school neighborhood characteristics and school accessibility.

## Teacher Effectiveness

Understanding that working conditions are related to turnover has value because it suggests leverage points that can be targeted for reducing turnover. Yet simply reducing turnover, without consideration for how it may impact the educational outcomes of students,

should not be the ultimate goal. Knowing which teachers are leaving and which teachers are staying, in terms of their ability to produce gains in student learning is also important. To the extent that efforts are made to retain effective teachers, turnover reduction should have a positive impact on student learning. A first step in designing interventions to retain effective teachers is to determine whether there are any differential probabilities of turnover associated with teacher effectiveness.

Using teacher value added measure scores as the measure of teacher effectiveness, this study indicated that while, in the MET sample of teachers, there was a slight positive association between effectiveness and turnover, the magnitude of the association was not strong enough to be considered statistically significant. In other words, as it concerns teacher effectiveness, a rational actor model which suggests that more effective teachers would have more employment opportunities outside of their school to choose from, because they would be more employable than less effective teachers, and would therefore have higher probabilities of turnover, could not be supported.

There are several possibilities that might explain this finding. For instance, VAM scores do not actually capture teacher attributes that act as signals in the job market. In other words, potential employers do not attend to VAM scores, or their correlates, when making their hiring decisions. If this were the case, the rational actor model would still hold for aspects of teacher quality other than teacher effectiveness. A similar possibility is that potential employers would select candidates based on VAM scores like those calculated by the MET, but that VAM scores are not accessible to these employers, and therefore they cannot make selections based on this criterion. This would be consistent with the construction of the VAM scores in the MET as being MET specific and not being made publicly available on an individual teacher basis. These

explanations for the finding share an assumption that VAM scores accurately and reliably measure teacher effectiveness. A divergent possibility is that effectiveness, as defined by a teachers' contribution to student learning, independent of other factors, is not fully being captured by the VAM score calculation used in the MET. In other words, more effective teachers may have higher departure rates, but VAM scores may serve as a poor measure of effectiveness. Future research into this topic may therefore benefit from using multiple VAM score calculations in the analysis of turnover, and specifically using a VAM score that situates a teacher within a broader teacher population.

Contrary to a model in which more effective teachers leave school to pursue better work opportunities, is the idea that more effective teachers would be less likely, rather than more likely to, leave their jobs. Effective teachers might experience psychic benefits from teaching and be more inclined to stay in their schools. This line of thinking, however, was also not supported by the data. A statistically significant negative relationship between VAM score and turnover was not discovered.

One explanation for this finding might be that teacher effectiveness and teacher self-efficacy, or a teacher's feeling of being successful, are not directly related. If this were the case, teachers who experienced higher levels of self-efficacy might derive more benefits from teaching and therefore be more inclined to stay in their jobs. Said another way, teachers may feel that they are making an impact on the learning outcomes of their students, when they may in fact not be. These teachers may simply feel responsible for gains in student learning that occurred independent of the teachers influence, gains that may have been more directly associated with student characteristics, peer effects, or school effects. The perception of effectiveness for these teachers, however, may be enough to produce the psychic effects that would then translate to

reduced probabilities of turnover. By its nature, this mechanism would not be expressed through an association between VAM score and turnover. Similarly, Teacher VAM scores and teacher feelings of success may have been independent because teachers were not made aware of the VAM scores that were calculated by the MET. The absence of measures of teacher self-efficacy makes it difficult to determine whether a correlation exists between measured and individually perceived effectiveness.The case may also be the VAM scores do not reflect all kinds of effective teaching, and that teachers who are effective in producing learning or educational outcomes not measured by standardized test scores are actually less likely to leave their schools. Future research will benefit from including a broader set of measures of teacher effectiveness to determine if such a process is at play.

Another possibility, given the null association between VAM and turnover, is that both a rational actor model, and a psychic benefit model are operant at the same time, just for different groups of people. For some teachers, having higher VAM scores may be associated with higher probabilities of turnover, while for other teachers higher VAM scores may actually be associated with lower probabilities of turnover. If the characteristics or attributes that identify the groups cannot be controlled for or interacted with VAM scores in the analytical models, this difference would emerge as a null finding for the role of VAM in turnover. One attribute that might play such a role is whether teachers self-identify as teachers or believe that teaching is a moral act. These teachers, upon feeling that they are being successful in their roles may more deeply experience the psychic benefits of teaching and therefore be more inclined to stay. Other teachers, who enter teaching motivated by other factors, may be more inclined to leave if they feel that through mechanisms associated with their effectiveness they can signal desirability to other employers.

In interpreting the VAM score findings, consideration must be made for the way in which the sample was constructed. Teachers in the sample were those who worked in schools that were willing to participate in a study on teacher effectiveness and who were themselves willing to be observed conducting their practice. This feature of the sampling process may have resulted in a sample of teachers who were overall more confident in their teaching ability than their non-participating peers, and who may have on average been more effective than their peers. Given these attributes of the sample and given that the value-added scores in the study are specific to MET teachers, the fact that the teacher effectiveness measure was not found to be statistically significantly related to turnover may partially be explained by the sampling procedure. This sample of teachers, while having variation in the VAM scores calculated by the MET, may actually have very little variation in their effectiveness relative to all other teaches in their districts, states, or even at the national level. This broader level of teacher effectiveness, not observed by the MET, may still be predictive of turnover at a statistically significant level.

Consideration should also be made for the period in which the data for this study was collected. The MET was conducted during the No Child Left Behind era, a time of heighted accountability measures and standardized testing. The emphasis on teaching practices that were designed to produced improved outcomes on standardized test measures may have resulted in the implementation of more constrained sets of teaching practices within classrooms. Such constraints would likely have served to only further truncate the variability in teaching effectiveness across teachers. The decrease in variability in effectiveness would have further contributed to a null finding for the role of teacher effectiveness in turnover.

## Working Conditions and Value-Added Model Scores

Ultimately, any analysis of the role of teacher effectiveness in turnover needs to account for the ways in which school effects, and particularly those associated with school working conditions, are or are not accounted for in VAM score calculations. If such factors contribute to VAM scores, and therefore bias the estimates of teacher contributions to student learning, the coefficients calculated for the role of VAM in turnover may be similarly biased. In the case of the MET sample VAM calculations, school effects and working conditions, are not explicitly included in the model that produces the teacher score. To determine if a biasing effect was potentially at play, this study compared the coefficients for VAM scores in turnover models that excluded working conditions to the coefficients for VAM scores that included working conditions.

Several interesting findings emerged from the analysis. In terms of simple correlational relationships between the variables, school mean values of teacher perceptions of working conditions, and teacher deviations from those means had different base associations with VAM. While school mean values of working conditions were slightly positively correlated with VAM scores, teacher deviations from the perspectives of the other teachers in the school were weakly *negatively* correlated with VAM scores. These findings suggest that schools with working conditions that are, on average, viewed more positively by teachers tend to have teachers who are more effective. Such a relationship might be expected to exist if either more effective teachers systematically select into schools with better working conditions, or if the working conditions in schools contribute to the effectiveness, or the VAM scores, of teachers. The findings also suggest, however, that within schools, more effective teachers view the working conditions as being *less* positive.

What is it about being a more effective teacher that might lead to a more negative evaluation of the work environment? One possibility might be that more effective teachers have higher expectations for both their students and their workplace. These higher expectations might drive teachers to push their students, encouraging them to do more so that they end up learning more in shorter periods of time. Simultaneously, these heightened expectations may translate to a less positive view, relative to other teachers in the same school, of the school working conditions. For instance, teachers with higher expectations may feel that the conditions in their school are not on par with what is required to perform their most effective teaching and may therefore rate the working conditions in their schools at a lower level than that of their peers. Determining whether this is the mechanism driving the relationship will require follow-up research specifically designed to address this topic.

Overall, the regression analysis conducted did not provide support for the hypothesis that including working conditions variables in a model of teacher effectiveness and turnover would change the inference made about effectiveness coefficient. Relative to the model with no working conditions variables, the coefficient for VAM score did increase slightly when school mean teacher perceptions of the working conditions were included in the model, though this increase was not enough to lead to a finding of statistical significance for the VAM score. The change in the coefficient, however, does suggest the possibility that amongst those populations of teachers in which higher VAM scores are positively related to turnover, failing to account for working conditions may lead to underestimations in teachers' probability of leaving their schools. Conversely, when substituting teacher deviations in perceptions from the other teachers for the school mean value of working conditions, the coefficient for VAM score decreased relative to the model with no working conditions variables turnover, though the change in the did

not result in statistically significant finding. When both the school mean teacher perceptions of the working conditions and the teacher deviation scores were included in the model, the odds ratio for teacher VAM score was largely unchanged. Additionally, AIC fit statistics indicated that models of turnover which included teacher VAM scores did not fit any better than otherwise comparable models that omitted the variable.

Importantly, even when conditioning on teacher VAM score, school working conditions at both the school level and the individual level maintained statistically significant negative relationship with turnover. This suggests that associations between working conditions and lower levels of turnover are not simply occurring because school with better working conditions tend to have better teachers, or because better teachers who would be more likely to stay report the working conditions as being better.

An important possibility to consider is that sampling procedures may be responsible for the finding that teacher effectiveness appeared independent of working conditions in relation to turnover. As indicated, the sample of schools included in the study contained a lower proportion of highly predominantly White schools that in previous studies on working conditions and turnover. Highly predominantly White schools might be expected to have better overall working conditions than those of the schools included in this study. As such, to the extent that working conditions bias the value-added model scores calculated for teachers, schools in which the most extreme bias occurs may have been excluded from the study. Including a broader set of schools and using a measure of effectiveness that was reflective of a teacher position relative to a broader population of teachers may have resulted in findings suggesting stronger correlations between the working conditions and teacher effectiveness measures, and subsequently more bias for the coefficients calculated for each of these variables in previous studies on teacher turnover.

The final stage of the analysis sought to determine whether an interactive relationship existed between school mean perceptions of working condition and teacher VAM score in their association with teacher turnover. While a statistically significant interaction between the variables was not found, results indicated that amongst the MET sample of teachers there was a slight negative value calculated for the interaction. In other words, as the working conditions in schools are perceived as being more positive, the increased probability of turnover associated with VAM scores is mitigated. In the MET, more effective teachers appear to be slightly less likely to turnover when they are working in schools with better organizational conditions. Despite the null finding regarding statistical significance of the interaction, future research into the role of teacher effectiveness and turnover, in populations that have an established relationship between VAM score and turnover, should consider incorporating an investigation of the potential for an interaction in those populations.

## Limitations and Future Directions

This study contributed to the field of teacher turnover research by simultaneously exploring the role of school working conditions and teacher effectiveness. The study expanded upon the approaches that have been used in the field in the past by employing a multi-level modeling approach, and by using a contextual effects framework for exploring the role of working conditions. Several limitations in the approach should be considered. First, due to the non-experimental design of the study, causal attributions about the roles of working conditions or teacher effectiveness cannot be made based on the findings presented, Second, while the MET

offered a rare opportunity to explore the research questions posed in this study, caution should be used when generalizing the finding out to broader populations of teachers. The MET sample was not constructed as a random sample drawn from the population, but rather was constrained to school districts affiliated with the Bill and Melinda Gates Foundations, and to schools and teachers willing to participate in a study on teacher effectiveness. To the extent that such a sample differs from other teachers in regard to their career decisions, results from the MET sample may be different from those that would have been observed with other teachers.

Interestingly, The MET attempted to exclude teachers who indicated that they did not intend to continue teaching in the second year of the study. If they were successful in filtering teachers this way, the data indicates that attitudes regarding turnover can change within the course of a given school year. As early as the administration of the MET Teacher Climate Survey, conducted after the sample was established, some teachers were already indicating that by that point they had intentions to leave. The fact that the sample may have been constrained in this way only highlights the importance of working conditions to teacher career decisions. The case may be that when teachers develop a negative impression of the work place, this may be sufficient to change their previously held attitudes about intending to stay in their schools.

A third limitation was the inability to distinguish between "movers" and "leavers," or to distinguish between those teachers who left their school and transferred to another school and those teachers who left the profession entirely. These two groups may constitute substantively dissimilar classes of teachers, that make decisions about whether to stay in their schools based on different criteria. For instance, movers may be more likely to respond to changes in school working conditions, or to feelings of being successful in their teaching, while leavers may be indifferent to such considerations, caring only to remove themselves from the profession of

teaching. As the role of both VAM scores and working conditions may differ across these groups, future studies should attempt to account for these differences in their analytic strategies, perhaps by employing a multinomial regression framework.

Continued understanding of the turnover process will also benefit from incorporating a broader set of teacher effectiveness measures. While this study did not find a statistically significant relationship between teacher VAM scores and turnover, this should not lead one to the conclusion that teacher effectiveness, teacher quality, or teacher self-efficacy do not matter. The case may simply be that VAM scores, as calculated by the MET, do not capture the aspects of effective teaching that matter most to teacher deciding to stay in or leaver their schools. In order to fully assess the extent to which rational actor models and psychic benefit models are at play, and for which teachers, turnover research will have to expand upon the measures of effectiveness currently being used. Measures drawn from student standardized test scores, or from teacher qualification indicators, may not be sufficient to tell the whole story.

Future research will also benefit from continued implementation of a contextual effect framework approach in the analysis of working conditions and from leveraging the teacher deviation scores in at least two ways. The first will be to use the overall variation in teacher perspectives of the working conditions in the school as a school-level predictor of turnover. This would shed light on whether teachers working in schools in which there is a greater overall level of agreement on the conditions within the school would be more likely to stay. The second will be to determine whether the absolute value of the deviation score is predictive of turnover at the individual level. This absolute value would serve as a partial indicator of a teacher's fit within the organization.

Another appropriate next step would be to explore the possibility of an interaction between school mean values of working conditions and teachers' deviations from those means. Its might be possible that the role of the deviation from other teachers in the school in predicting turnover changes based on the overall conditions in the school. There may, for instance, be a buffering effect against turnover for teachers who view their schools as being more positive than the other teachers in their schools if they are already working in well-organized schools to begin with.

Ultimately, attempts to bring equity to schools by reducing turnover, and ensuring that the most effective teachers stay in their schools, will need to continue to grapple with the ways that the organizational conditions of the schools and the effectiveness of the teachers are intertwined. Studies of turnover should no longer attempt to understand the role of one, while discounting the importance of the other.

APPENDIX A – TABLES AND FIGURES

*Figure 1. Cohen et al. (2003) model of instruction as interaction*

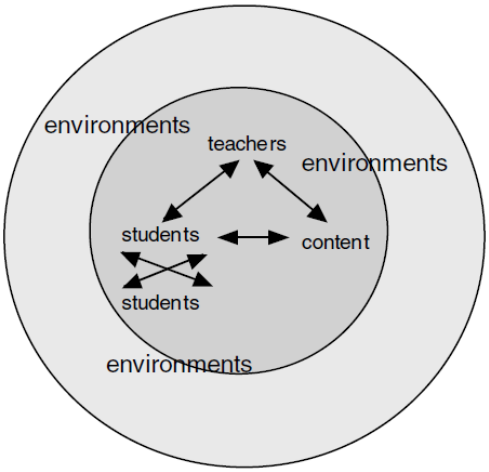


*Figure 2. Framework for turnover*

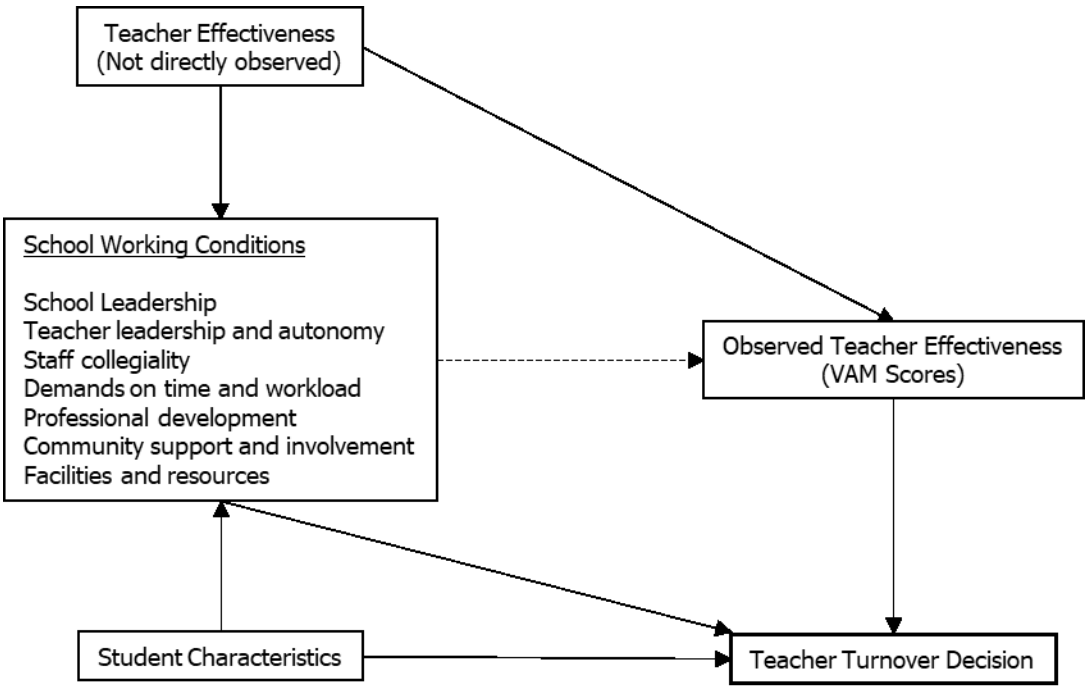

*Table 1. Potential relationships between working conditions and teacher effectiveness*

| | Working conditions contribute to VAM scores | WC do not contribute to VAM scores |
|---|---|---|
| Effectiveness contributes to turnover. | 1) The role of working conditions partially explain any observed relationship between effectiveness and turnover. | 2) The role of the two variables in their relationship to turnover would be independent, however estimates for either variable might still be biased if effective teachers sort into schools with better working conditions. |
| Effectiveness is independent of turnover. | 3) Working conditions partially or fully explain any observed relationship between effectiveness and turnover. | 4) Relationship between working conditions and turnover would solely be attributable to feelings of satisfaction with the workplace that are independent of effectiveness or VAM scores. |

*Table 2. Comparison of analytic sample to full MET sample*

| | | *Analytic sample* | | *MET Sample w partial data* | |
|---|---|---|---|---|---|
| | *Variable* | *Freq* | *Percent* | *Obs. w. data* | *Percent* |
| **Gender** | | | | | |
| | Male | 198 | 17.16 | 1939 | 18.10 |
| | Female | 956 | 82.84 | 1939 | 81.90 |
| **Race** | | | | | |
| | White | 755 | 65.42 | 1938 | 58.67 |
| | Black | 315 | 27.3 | 1938 | 33.69 |
| | Hispanic | 62 | 5.37 | 1938 | 5.47 |
| | Other | 22 | 1.91 | 1938 | 2.17 |
| **Experience** | | | | | |
| | New teacher | 222 | 19.24 | 1531 | 20.12 |
| | >3 Years | 932 | 80.76 | 1531 | 79.88 |
| **Grade level** | | | | | |
| | Elementary | 430 | 37.26 | 2021 | 36.32 |
| | MS/HS | 724 | 62.74 | 2021 | 63.68 |
| **Subject** | | | | | |
| | ELA | 463 | 40.12 | 2021 | 39.34 |
| | Generalist | 277 | 24.00 | 2021 | 26.92 |
| | Math | 414 | 35.88 | 2021 | 33.75 |

| | | *Mean* | *SD* | *Obs. w. data* | *Mean* | *SD* |
|---|---|---|---|---|---|---|
| **Effectiveness** | | | | | | |
| | VAM | 0.00 | 0.30 | 1924 | -0.01 | 0.32 |
| **Working Conditions Composite** | | | | | | |
| | Teacher Raw Score | 50.24 | 7.35 | 1530 | 50.12 | 7.47 |
| | School Mean | 50.23 | 4.50 | 1963 | 49.77 | 4.84 |
| | Deviation | 0.01 | 5.82 | 1530 | 0.00 | 5.81 |

*Table 3. Sample Characteristics*

| | | | | | |
|---|---|---|---|---|---|
| Number of Teachers | | 1,154 | | | |
| Number of Schools | | 148 | | | |
| Responding teachers per school | | *Mean* | *Std. Dev.* | *Min* | *Max* |
| | | 7.80 | 3.00 | 5 | 19 |
| Outcome | | *Freq.* | *Percent* | | |
| | Stayers | 869 | 75.3 | | |
| | Leavers | 285 | 24.7 | | |

*Table 4. Teacher Characteristics by outcome*

| | | | | *Turnover=1* | | *Turnover=0* | |
|---|---|---|---|---|---|---|---|
| | *Variable* | *Freq* | *Percent* | *Freq* | *Percent* | *Freq* | *Percent* |
| **Gender** | | | | | | | |
| | Male | 198 | 17.16 | 44 | 15.44 | 154 | 17.72 |
| | Female | 956 | 82.84 | 241 | 84.56 | 715 | 82.28 |
| **Race** | | | | | | | |
| | White | 755 | 65.42 | 193 | 67.72 | 562 | 64.67 |
| | Black | 315 | 27.3 | 75 | 26.32 | 240 | 27.62 |
| | Hispanic | 62 | 5.37 | 13 | 4.56 | 49 | 5.64 |
| | Other | 22 | 1.91 | 4 | 1.4 | 18 | 2.07 |
| **Experience** | | | | | | | |
| | New teacher | 222 | 19.24 | 70 | 24.56 | 152 | 17.49 |
| | >3 Years | 932 | 80.76 | 215 | 75.44 | 717 | 82.51 |
| **Grade level** | | | | | | | |
| | Elementary | 430 | 37.26 | 119 | 41.75 | 311 | 35.79 |
| | MS/HS | 724 | 62.74 | 166 | 58.25 | 558 | 64.21 |
| **Subject** | | | | | | | |
| | ELA | 463 | 40.12 | 122 | 42.81 | 341 | 39.24 |
| | Generalist | 277 | 24.00 | 82 | 28.77 | 195 | 22.44 |
| | Math | 414 | 35.88 | 81 | 28.42 | 333 | 38.32 |
| **School Type** | | | | | | | |
| | Predominantly White | 311 | 26.95 | 50 | 17.54 | 261 | 30.03 |
| | Predominantly Minority | 843 | 73.05 | 235 | 82.46 | 608 | 69.97 |

| | | *Mean* | *SD* | *Mean* | *SD* | *Mean* | *SD* |
|---|---|---|---|---|---|---|---|
| **Effectiveness** | | | | | | | |
| | VAM | 0.00 | 0.30 | 0.02 | 0.31 | 0.00 | 0.30 |
| **Working Conditions Composite** | | | | | | | |
| | Teacher Raw Score | 50.24 | 7.35 | 47.88 | 7.31 | 51.02 | 7.20 |
| | School Mean | 50.23 | 4.50 | 49.08 | 4.15 | 50.61 | 4.55 |
| | Deviation | 0.01 | 5.82 | -1.20 | 5.84 | 0.41 | 5.76 |

*Table 5. Correlation coefficients of teacher demographics and working conditions raw scores*

| | *Turnover* | *Male* | *White* | *Black* | *Hispanic* | *Other Race* | *New Teacher* | *Middle/ High School* | *Generalist* | *Math* | *ELA* |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Turnover | 1.00 | | | | | | | | | | |
| Male | -0.03 | 1.00 | | | | | | | | | |
| White | 0.03 | -0.02 | 1.00 | | | | | | | | |
| Black | -0.01 | 0.00 | -0.84 | 1.00 | | | | | | | |
| Hispanic | -0.02 | -0.01 | -0.33 | -0.15 | 1.00 | | | | | | |
| Other Race | -0.02 | 0.07 | -0.19 | -0.09 | -0.03 | 1.00 | | | | | |
| New Teacher | 0.08 | 0.02 | 0.07 | -0.10 | 0.06 | -0.02 | 1.00 | | | | |
| Middle/High School | -0.05 | 0.17 | -0.04 | 0.03 | -0.02 | 0.07 | 0.08 | 1.00 | | | |
| Generalist | 0.06 | -0.13 | -0.08 | 0.11 | -0.02 | -0.06 | -0.07 | -0.71 | 1.00 | | |
| Math | -0.09 | 0.18 | -0.01 | -0.02 | 0.01 | 0.09 | 0.02 | 0.30 | -0.42 | 1.00 | |
| ELA | 0.03 | -0.06 | 0.07 | -0.07 | 0.01 | -0.04 | 0.04 | 0.32 | -0.46 | -0.61 | 1.00 |
| VAM | 0.03 | -0.04 | -0.01 | 0.04 | -0.03 | -0.03 | -0.05 | 0.00 | 0.00 | 0.01 | -0.01 |
| Sch. Predominantly Minority | 0.12 | 0.06 | -0.23 | 0.24 | -0.02 | 0.04 | 0.08 | -0.05 | 0.17 | -0.07 | -0.08 |
| Sch. Prior Achievement | -0.08 | -0.07 | 0.27 | -0.30 | 0.02 | 0.00 | -0.14 | -0.03 | -0.13 | 0.04 | 0.07 |

*Table 5 (cont). Correlation coefficients of teacher demographics and working conditions raw scores*

| | *Turnover* | *Male* | *White* | *Black* | *Hispanic* | *Other Race* | *New Teacher* | *Middle/ High School* | *Generalist* | *Math* | *ELA* |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Working Conditions Raw Score | -0.18 | 0.00 | -0.04 | 0.02 | 0.04 | 0.00 | -0.06 | -0.18 | 0.06 | 0.02 | -0.07 |
| Time | -0.18 | 0.05 | -0.05 | 0.03 | 0.03 | 0.02 | -0.05 | -0.02 | -0.04 | 0.07 | -0.04 |
| Resources | -0.16 | 0.05 | -0.01 | -0.01 | 0.05 | 0.00 | -0.03 | -0.11 | 0.03 | 0.04 | -0.06 |
| Community Support | -0.13 | -0.06 | 0.06 | -0.07 | 0.02 | -0.02 | -0.11 | -0.19 | 0.03 | 0.01 | -0.03 |
| Student Conduct | -0.17 | -0.02 | 0.02 | -0.03 | 0.03 | -0.01 | -0.07 | -0.25 | 0.08 | -0.02 | -0.05 |
| Teacher Leadership | -0.14 | 0.03 | -0.02 | 0.01 | 0.04 | 0.00 | -0.02 | -0.16 | 0.05 | 0.05 | -0.09 |
| School Leadership | -0.18 | 0.00 | -0.05 | 0.02 | 0.05 | 0.02 | -0.05 | -0.18 | 0.08 | 0.01 | -0.08 |
| Professional Development | -0.12 | -0.02 | -0.07 | 0.07 | 0.01 | 0.00 | -0.02 | -0.16 | 0.12 | -0.02 | -0.08 |
| Instructional Practice and Support | -0.09 | -0.01 | -0.11 | 0.11 | 0.01 | 0.00 | -0.06 | -0.07 | 0.06 | -0.01 | -0.04 |

*Table 5 (cont). Correlation coefficients of teacher demographics and teacher working conditions raw scores*

| | *VAM* | *Predominantly Minority* | *Prior Achievement* | *WC Composite Raw Score* | *Time* | *Resources* | *Community Support* | *Student Conduct* | *Teacher Leadership* | *School Leadership* | *Professional Development* | *Instructional Practice and Support* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| VAM | 1.00 | | | | | | | | | | | |
| Predominantly Minority | 0.00 | 1.00 | | | | | | | | | | |
| Prior Achievement | 0.02 | -0.57 | 1.00 | | | | | | | | | |
| WC Composite Raw Score | -0.03 | -0.29 | 0.28 | 1.00 | | | | | | | | |
| Time | -0.05 | -0.16 | 0.13 | 0.72 | 1.00 | | | | | | | |
| Resources | -0.01 | -0.22 | 0.21 | 0.77 | 0.55 | 1.00 | | | | | | |
| Community Support | -0.02 | -0.42 | 0.45 | 0.73 | 0.39 | 0.48 | 1.00 | | | | | |
| Student Conduct | 0.01 | -0.29 | 0.32 | 0.81 | 0.50 | 0.55 | 0.65 | 1.00 | | | | |
| Teacher Leadership | -0.04 | -0.21 | 0.20 | 0.85 | 0.56 | 0.59 | 0.56 | 0.65 | 1.00 | | | |
| School Leadership | -0.02 | -0.21 | 0.20 | 0.89 | 0.59 | 0.62 | 0.59 | 0.70 | 0.78 | 1.00 | | |
| Professional Development | -0.03 | -0.16 | 0.10 | 0.79 | 0.49 | 0.54 | 0.47 | 0.52 | 0.64 | 0.72 | 1.00 | |
| Instructional Practice and Support | -0.01 | -0.17 | 0.13 | 0.78 | 0.52 | 0.50 | 0.46 | 0.51 | 0.61 | 0.69 | 0.66 | 1.00 |

*Table 6. Teacher characteristics by school type*

| | *Predominantly White* | | *Predominantly Minority* | |
|---|---|---|---|---|
| | *Freq.* | *Pct.* | *Freq.* | *Pct.* |
| Stayers | 261 | 83.92 | 608 | 72.12 |
| Leavers | 50 | 16.08 | 235 | 27.88 |
| | | | | |
| New Teachers | 43 | 13.83 | 179 | 21.23 |
| Experienced Teachers | 268 | 86.17 | 664 | 78.77 |
| | *Mean* | *Std. Dev* | *Mean* | *Std. Dev.* |
| VAM Score | 0.00 | 0.28 | 0.00 | 0.31 |
| Working Conditions Composite Raw Score | 53.79 | 7.44 | 48.93 | 6.87 |

*Table 7. Regression coefficients for teacher and school variables in odds ratios*

| | *Model 1* | | *Model 2* | | *Model 3* | | *Model 4* | | *Model 5* | | *Model 6* | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Male | | | 0.94 | (0.19) | | | | | | | 0.91 | (0.19) |
| Black | | | **0.69*** | **(0.14)** | | | | | | | **0.63**** | **(0.13)** |
| Hispanic | | | 0.74 | (0.26) | | | | | | | 0.74 | (0.26) |
| Other Race | | | 0.67 | (0.40) | | | | | | | 0.64 | (0.38) |
| New Teacher | | | **1.73***** | **(0.31)** | | | | | | | **1.61**** | **(0.29)** |
| Middle/High School | | | 0.96 | (0.26) | | | | | | | 0.94 | (0.25) |
| ELA Teacher | | | 0.88 | (0.28) | | | | | | | 0.97 | (0.31) |
| Math Teacher | | | 0.59 | (0.20) | | | | | | | 0.66 | (0.22) |
| Sch. Predominantly Minority | | | | | **2.04***** | **(0.47)** | | | **1.83**** | **(0.49)** | **1.81**** | **(0.48)** |
| Sch. Prior Ach. ELA | | | | | | | **0.59**** | **(0.14)** | 0.80 | (0.21) | 0.77 | 0.21 |
| Intercept | **0.28***** | **(0.04)** | **0.38***** | **(0.10)** | **0.19***** | **(0.04)** | **0.31***** | **(0.05)** | **0.21***** | **(0.05)** | **0.27***** | **(0.09)** |
| Tao 00 | 0.34 | (0.15) | 0.34 | (0.15) | 0.27 | (0.14) | 0.30 | (0.14) | 0.27 | (0.14) | 0.27 | (0.14) |
| Parameters | 7 | | 15 | | 8 | | 8 | | 9 | | 17 | |
| log likelihood | -633.48 | | -622.62 | | -628.60 | | -630.82 | | -628.25 | | -617.43 | |
| -2*log likelihood | 1266.96 | | 1245.24 | | 1257.20 | | 1261.65 | | 1256.49 | | 1234.87 | |
| AIC | 1280.96 | | 1275.24 | | 1273.20 | | 1277.65 | | 1274.49 | | 1268.87 | |
| ICC | 0.09 | | 0.09 | | 0.08 | | 0.08 | | 0.08 | | 0.07 | |

*p<.1, **p<.05, ***p<.001

*Table 8. School-level characteristics*

| *Variable* | | | | | |
|---|---|---|---|---|---|
| **School Type** | | *Freq* | *Pct.* | | |
| | Predominantly White | 36 | 24.32 | | |
| | Predominantly Minority | 112 | 75.68 | | |
| | | *Mean* | *Std. Dev.* | *Min* | *Max* |
| **Prior Achievement** | | | | | |
| | ELA | 0.07 | 0.40 | -0.85 | 1.05 |
| **Working Conditions** | | | | | |
| | Composite | 50.20 | 4.62 | 37.86 | 67.99 |
| | Time | 50.34 | 4.81 | 40.64 | 66.32 |
| | Resources | 50.45 | 5.56 | 33.36 | 71.16 |
| | Community Support | 49.79 | 6.90 | 35.05 | 72.93 |
| | Student Conduct | 50.01 | 6.68 | 34.57 | 69.02 |
| | Teacher Leadership | 50.28 | 5.35 | 35.97 | 67.15 |
| | School Leadership | 49.88 | 5.02 | 38.77 | 67.89 |
| | Professional Development | 50.05 | 4.79 | 36.49 | 69.64 |
| | Inst. Supp. | 50.71 | 4.42 | 40.93 | 69.68 |

*Table 9. Correlation coefficients of school-level variables (n=148 schools)*

| | Predominantly Minority | Prior Achievement | WC Composite | Time | Resources | Community Support | Student Conduct | Teacher Leadership | School Leadership | Professional Development | Instructional Practice and Support |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Predominantly Minority | 1.00 | | | | | | | | | | |
| Prior Achievement | -0.54 | 1.00 | | | | | | | | | |
| WC Composite | -0.44 | 0.44 | 1.00 | | | | | | | | |
| Time | -0.30 | 0.23 | 0.76 | 1.00 | | | | | | | |
| Resources | -0.37 | 0.34 | 0.83 | 0.63 | 1.00 | | | | | | |
| Community Support | -0.56 | 0.62 | 0.82 | 0.49 | 0.61 | 1.00 | | | | | |
| Student Conduct | -0.40 | 0.46 | 0.89 | 0.61 | 0.67 | 0.78 | 1.00 | | | | |
| Teacher Leadership | -0.32 | 0.33 | 0.90 | 0.65 | 0.68 | 0.67 | 0.77 | 1.00 | | | |
| School Leadership | -0.37 | 0.37 | 0.95 | 0.70 | 0.73 | 0.73 | 0.85 | 0.89 | 1.00 | | |
| Professional Development | -0.28 | 0.20 | 0.84 | 0.58 | 0.71 | 0.58 | 0.64 | 0.76 | 0.79 | 1.00 | |
| Instructional Practice and Support | -0.33 | 0.26 | 0.79 | 0.55 | 0.57 | 0.58 | 0.62 | 0.69 | 0.75 | 0.72 | 1.00 |

*Table 10. Regression coefficients for working conditions models without control variables, in odds ratios*

| | *Model 1* | | *Model 2* | | *Model 3* | | *Model 4* | |
|---|---|---|---|---|---|---|---|---|
| Teacher Raw Score (Sch mean + deviation) | **0.93*** ** | **(0.01)** | | | | | | |
| School Mean | | | **0.91*** ** | **(0.02)** | | | **0.90*** ** | **(0.02)** |
| Teacher Deviation | | | | | **0.95*** ** | **(0.01)** | **0.95*** ** | **(0.01)** |
| Intercept | **0.30*** ** | **(0.04)** | **0.32*** ** | **(0.04)** | **0.28*** ** | **(0.04)** | **0.31*** ** | **(0.04)** |
| Tao 00 | 0.23 | (0.13) | 0.19 | (0.13) | 0.37 | (0.16) | 0.21 | (0.13) |
| Parameters | 8 | | 8 | | 8 | | 9 | |
| log likelihood | -615.25 | | -622.87 | | -624.44 | | -613.53 | |
| -2*log likelihood | 1230.51 | | 1245.74 | | 1248.89 | | 1227.07 | |
| AIC | 1246.51 | | 1261.74 | | 1264.89 | | 1245.07 | |
| ICC | 0.06 | | 0.05 | | 0.10 | | 0.06 | |

*p<.1, **p<.05, ***p<.001

*Figure 3. Teacher working conditions raw scores by school type*

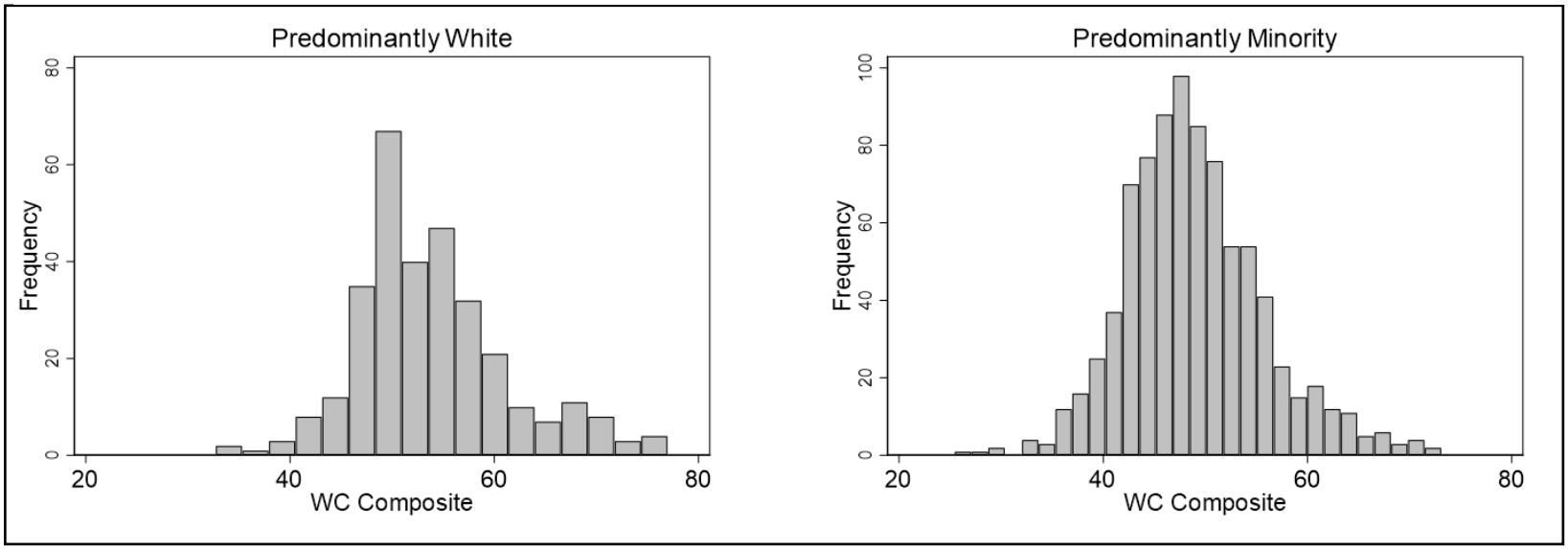

*Table 11. Regression coefficients for working conditions models with control variables, in odds ratios*

| | *Model 1* | | *Model 2* | | *Model 3* | | *Model 4* | |
|---|---|---|---|---|---|---|---|---|
| Teacher Raw Score (Sch mean + deviation) | **0.94*** ** | **(0.01)** | | | | | | |
| School Mean | | | **0.91*** ** | **(0.02)** | | | **0.91*** ** | **(0.02)** |
| Teacher Deviation | | | | | **0.95*** ** | **(0.01)** | **0.95*** ** | **(0.01)** |
| Male | 0.95 | (0.20) | 0.91 | (0.19) | 0.94 | (0.20) | 0.94 | (0.19) |
| Black | **0.72*** | **(0.14)** | **0.64**** | **(0.13)** | **0.69*** | **(0.14)** | **0.71*** | **(0.14)** |
| Hispanic | 0.81 | (0.28) | 0.75 | (0.26) | 0.79 | (0.28) | 0.80 | (0.28) |
| Other Race | 0.74 | (0.44) | 0.66 | (0.38) | 0.71 | (0.42) | 0.72 | (0.43) |
| New Teacher | **1.61*** ** | **(0.30)** | **1.63*** ** | **(0.29)** | **1.60**** | **(0.30)** | **1.63*** ** | **(0.30)** |
| Middle/High School | 0.79 | (0.20) | 0.77 | (0.20) | 0.90 | (0.24) | 0.73 | (0.19) |
| ELA Teacher | 1.00 | (0.31) | 0.99 | (0.30) | 0.99 | (0.32) | 1.00 | (0.31) |
| Math Teacher | 0.71 | (0.23) | 0.68 | (0.21) | 0.69 | (0.23) | 0.72 | (0.23) |
| Sch. Predominantly Minority | 1.51 | (0.39) | 1.37 | (0.36) | **1.81**** | **(0.49)** | 1.36 | (0.36) |
| Sch Prior Achievement ELA | 0.92 | (0.25) | 0.99 | (0.27) | 0.78 | (0.22) | 1.02 | (0.28) |
| Intercept | **0.32*** ** | **(0.10)** | **0.38*** ** | **(0.11)** | **0.26*** ** | **(0.08)** | **0.36*** ** | **(0.11)** |
| Tao 00 | 0.19 | (0.13) | 0.16 | (0.12) | 0.29 | (0.14) | 0.17 | (0.12) |
| Parameters | 18 | | 18 | | 18 | | 19 | |
| log likelihood | -603.81 | | -609.42 | | -610.54 | | -602.13 | |
| -2*log likelihood | 1207.625 | | 1218.835 | | 1221.087 | | 1204.26 | |
| AIC | 1243.625 | | 1254.835 | | 1257.087 | | 1242.26 | |
| ICC | 0.05 | | 0.05 | | 0.08 | | 0.05 | |

*p<.1, **p<.05, ***p<.001

*Figure 4. Predicted probabilities of turnover by working conditions variables*

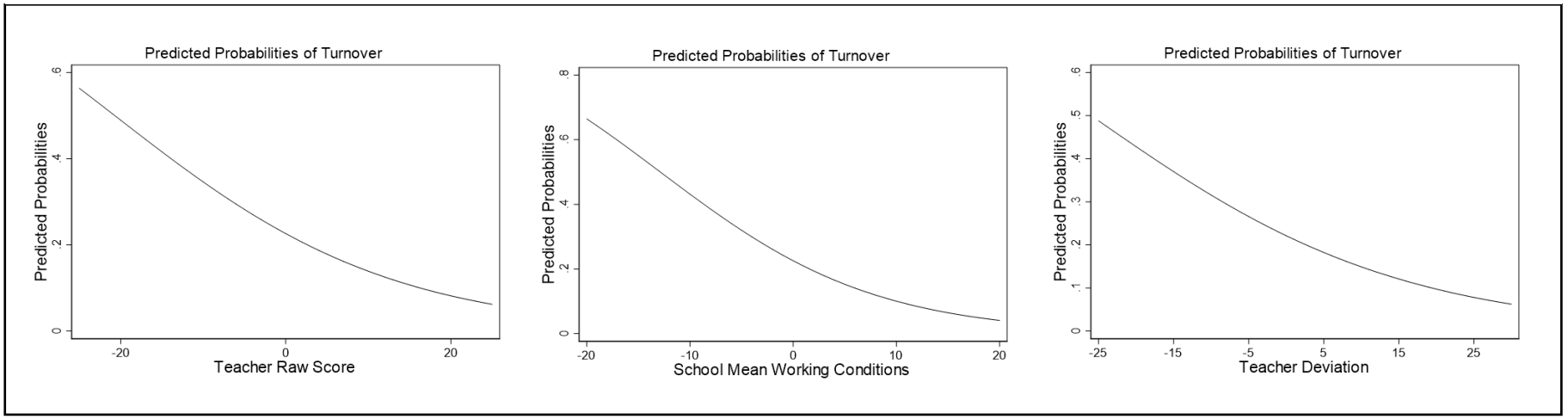

*Table 12. Working conditions variables by outcome*

| | *All Teachers* | | *Turnover =1* | | *Turnover = 0* | |
|---|---|---|---|---|---|---|
| | *Mean* | *SD* | *Mean* | *SD* | *Mean* | *SD* |
| **Teacher Raw Score** | | | | | | |
| Time | 50.57 | 8.50 | 47.91 | 8.54 | 51.44 | 8.31 |
| Resources | 50.52 | 9.79 | 47.79 | 9.41 | 51.42 | 9.76 |
| Community Support | 50.05 | 9.77 | 47.90 | 9.71 | 50.76 | 9.69 |
| Student Conduct | 49.91 | 9.83 | 46.95 | 9.67 | 50.88 | 9.69 |
| Teacher Leadership | 50.26 | 8.84 | 48.05 | 9.23 | 50.99 | 8.59 |
| School Leadership | 49.83 | 8.79 | 47.01 | 8.49 | 50.75 | 8.69 |
| PD | 49.92 | 9.30 | 48.02 | 9.10 | 50.55 | 9.29 |
| Inst. Supp. | 50.88 | 9.49 | 49.41 | 9.62 | 51.36 | 9.40 |
| **School Mean** | | | | | | |
| Time | 50.54 | 4.55 | 49.43 | 4.54 | 50.90 | 4.49 |
| Resources | 50.51 | 5.49 | 49.28 | 5.32 | 50.91 | 5.48 |
| Community Support | 50.08 | 6.92 | 48.75 | 6.31 | 50.51 | 7.06 |
| Student Conduct | 49.91 | 6.57 | 48.28 | 6.33 | 50.45 | 6.57 |
| Teacher Leadership | 50.24 | 5.18 | 49.17 | 5.09 | 50.59 | 5.17 |
| School Leadership | 49.83 | 4.92 | 48.71 | 4.58 | 50.20 | 4.98 |
| PD | 49.94 | 4.57 | 49.20 | 4.19 | 50.18 | 4.66 |
| Inst. Supp. | 50.80 | 4.34 | 49.80 | 3.65 | 51.12 | 4.49 |
| **Deviation** | | | | | | |
| Time | 0.03 | 7.19 | -1.52 | 7.31 | 0.54 | 7.09 |
| Resources | 0.02 | 8.13 | -1.49 | 7.85 | 0.51 | 8.17 |
| Community Support | -0.02 | 6.94 | -0.85 | 7.04 | 0.25 | 6.89 |
| Student Conduct | 0.00 | 7.28 | -1.33 | 7.02 | 0.43 | 7.31 |
| Teacher Leadership | 0.03 | 7.19 | -1.12 | 7.36 | 0.40 | 7.10 |
| School Leadership | 0.00 | 7.32 | -1.70 | 7.08 | 0.55 | 7.31 |
| PD | -0.01 | 8.12 | -1.18 | 7.95 | 0.37 | 8.14 |
| Inst. Supp. | 0.09 | 8.41 | -0.39 | 8.78 | 0.24 | 8.29 |

*Table 13. Regression coefficients for individual working conditions scales, in odds ratios*

| | *Time* | | *Facilities And Resources.* | | *Comm. Supp.* | | *Student Conduct Mgmt.* | |
|---|---|---|---|---|---|---|---|---|
| School Mean | **0.93*** ** | **(0.02)** | **0.94*** ** | (0.02) | **0.97*** | **(0.02)** | **0.94*** ** | **(0.02)** |
| Teacher Deviation | **0.96*** ** | **(0.01)** | **0.97*** ** | (0.01) | **0.98*** | **(0.01)** | **0.97*** ** | **(0.01)** |
| Male | 0.94 | (0.19) | 0.96 | (0.20) | 0.91 | (0.19) | 0.94 | (0.19) |
| Black | **0.69*** | **(0.14)** | **0.66**** | **(0.13)** | **0.67**** | **(0.13)** | **0.69*** | **(0.14)** |
| Hispanic | 0.78 | (0.27) | 0.79 | (0.28) | 0.75 | (0.26) | 0.76 | (0.26) |
| Other Race | 0.68 | (0.40) | 0.68 | (0.40) | 0.69 | (0.40) | 0.70 | (0.41) |
| New Teacher | **1.58**** | **(0.29)** | **1.65*** ** | **(0.30)** | **1.58**** | **(0.29)** | **1.59**** | **(0.29)** |
| Middle/High School | 0.88 | (0.23) | 0.83 | (0.22) | 0.83 | (0.22) | 0.65 | (0.17) |
| ELA Teacher | 0.96 | (0.30) | 0.97 | (0.30) | 1.02 | (0.32) | 1.13 | (0.35) |
| Math Teacher | 0.69 | (0.22) | 0.68 | (0.22) | 0.70 | (0.23) | 0.79 | (0.25) |
| Sch. Predominantly Minority | **1.57*** | **(0.41)** | **1.54*** | **(0.40)** | 1.55 | (0.43) | 1.44 | (0.37) |
| Sch Prior Achievement ELA | 0.82 | (0.22) | 0.89 | (0.24) | 0.98 | (0.30) | 1.07 | (0.29) |
| Intercept | **0.32*** ** | **(0.10)** | **0.33*** ** | **(0.10)** | **0.31*** ** | **(0.10)** | **0.34*** ** | **(0.10)** |
| Tao 00 | 0.21 | (0.13) | 0.20 | (0.13) | 0.24 | (0.13) | 0.15 | (0.12) |
| Parameters | 19 | | 19 | | 19 | | 19 | |
| log likelihood | -604.22 | | -605.69 | | -614.11 | | -604.09 | |
| -2*log likelihood | 1208.45 | | 1211.37 | | 1228.21 | | 1208.19 | |
| AIC | 1246.45 | | 1249.37 | | 1266.21 | | 1246.19 | |
| ICC | 0.06 | | 0.06 | | 0.07 | | 0.04 | |

*p<.1, **p<.05, ***p<.001

*Table 14. Regression coefficients for individual working conditions scales, in odds ratios (cont)*

| | *Teacher Leadership* | | *School Leadership* | | *Professional Development* | | *Inst. Supp.* | |
|---|---|---|---|---|---|---|---|---|
| School Mean | **0.94*** ** | **(0.02)** | **0.93*** ** | **(0.02)** | **0.93*** ** | **(0.02)** | **0.91*** ** | **(0.02)** |
| Teacher Deviation | **0.97*** ** | **(0.01)** | **0.95*** ** | **(0.01)** | **0.98*** ** | **(0.01)** | 0.99 | (0.01) |
| Male | 0.95 | (0.20) | 0.93 | (0.19) | 0.92 | (0.19) | 0.91 | (0.19) |
| Black | **0.67** ** | **(0.13)** | **0.68*** | **(0.14)** | **0.67** ** | **(0.14)** | **0.66** ** | **(0.13)** |
| Hispanic | 0.78 | (0.27) | 0.82 | (0.29) | 0.76 | (0.26) | 0.77 | (0.26) |
| Other Race | 0.66 | (0.39) | 0.73 | (0.43) | 0.67 | (0.40) | 0.65 | (0.38) |
| New Teacher | **1.66*** ** | **(0.31)** | **1.64*** ** | **(0.30)** | **1.66*** ** | **(0.30)** | **1.63*** ** | **(0.30)** |
| Middle/High School | 0.80 | (0.21) | 0.76 | (0.20) | 0.84 | (0.22) | 0.90 | (0.23) |
| ELA Teacher | 1.00 | (0.31) | 0.97 | (0.30) | 0.90 | (0.28) | 0.94 | (0.29) |
| Math Teacher | 0.72 | (0.23) | 0.70 | (0.23) | 0.62 | (0.20) | 0.64 | (0.20) |
| Sch. Predominantly Minority | **1.62*** | **(0.42)** | 1.47 | (0.39) | 1.52 | (0.41) | 1.33 | (0.35) |
| Sch Prior Achievement ELA | 0.91 | (0.25) | 0.92 | 0.25 | 0.80 | (0.22) | 0.85 | (0.23) |
| Intercept | **0.32*** ** | **(0.10)** | **0.34*** ** | **(0.10)** | **0.35*** ** | **(0.11)** | **0.32*** ** | **(0.10)** |
| Tao 00 | 0.21 | (0.13) | 0.20 | (0.13) | 0.23 | (0.13) | 0.18 | (0.12) |
| Parameters | 19 | | 19 | | 19 | | 19 | |
| log likelihood | -608.23 | | -601.03 | | -609.21 | | -609.75 | |
| -2*log likelihood | 1216.46 | | 1202.05 | | 1218.43 | | 1219.51 | |
| AIC | 1254.46 | | 1240.05 | | 1256.43 | | 1257.51 | |
| ICC | 0.06 | | 0.06 | | 0.06 | | 0.05 | |

*p<.1, **p<.05, ***p<.001

*Table 15. Adjusted p values from Benjamini-Hochberg procedure for working conditions scales*

| | School Mean | | | Deviation | | |
|---|---|---|---|---|---|---|
| Variable | *p Value* | *Rank* | *Adjusted Critical p Value* | *p Value* | *Rank* | *Adjusted Critical p Value* |
| Time | 0.001 | 5 | 0.031 | 0 | 1 | 0.006 |
| Resources | 0 | 1 | 0.006 | 0.001 | 3 | 0.019 |
| Community Support | 0.085 | 8 | 0.050 | 0.053 | 7 | 0.044 |
| Student Conduct | 0 | 2 | 0.013 | 0.001 | 4 | 0.025 |
| Teacher Leadership | 0.002 | 6 | 0.038 | 0.004 | 5 | 0.031 |
| School Leadership | 0 | 3 | 0.019 | 0 | 2 | 0.013 |
| Professional Development | 0.002 | 7 | 0.044 | 0.008 | 6 | 0.038 |
| Inst. Supp. | 0 | 4 | 0.025 | 0.509 | 8 | 0.050 |

*Table 16. Regression coefficients for VAM scores, in odds ratios*

| | *Model 1* | | *Model 2* | |
|---|---|---|---|---|
| Teacher VAM Score | 1.20 | (0.29) | 1.27 | (0.30) |
| Male | | | 0.92 | (0.19) |
| Black | | | **0.63**** | **(0.13)** |
| Hispanic | | | 0.74 | (0.26) |
| Other Race | | | 0.65 | (0.38) |
| New Teacher | | | **1.62***** | **(0.30)** |
| Middle/High School | | | 0.94 | (0.25) |
| ELA Teacher | | | 0.97 | (0.31) |
| Math Teacher | | | 0.66 | (0.22) |
| Sch. Predominantly Minority | | | **1.81**** | **(0.48)** |
| Sch Prior Achievement ELA | | | 0.77 | (0.21) |
| Intercept | **0.28***** | **(0.04)** | **0.27***** | **(0.08)** |
| Tao 00 | 0.34 | (0.15) | 0.27 | (0.14) |
| Parameters | 8 | | 18 | |
| log likelihood | -633.18 | | -616.95 | |
| -2*log likelihood | 1266.36368 | | 1233.90 | |
| AIC | 1282.36368 | | 1269.90 | |
| ICC | 0.09 | | 0.07 | |

*p<.1, **p<.05, ***p<.001

*Figure 5. VAM scores by working conditions variables*

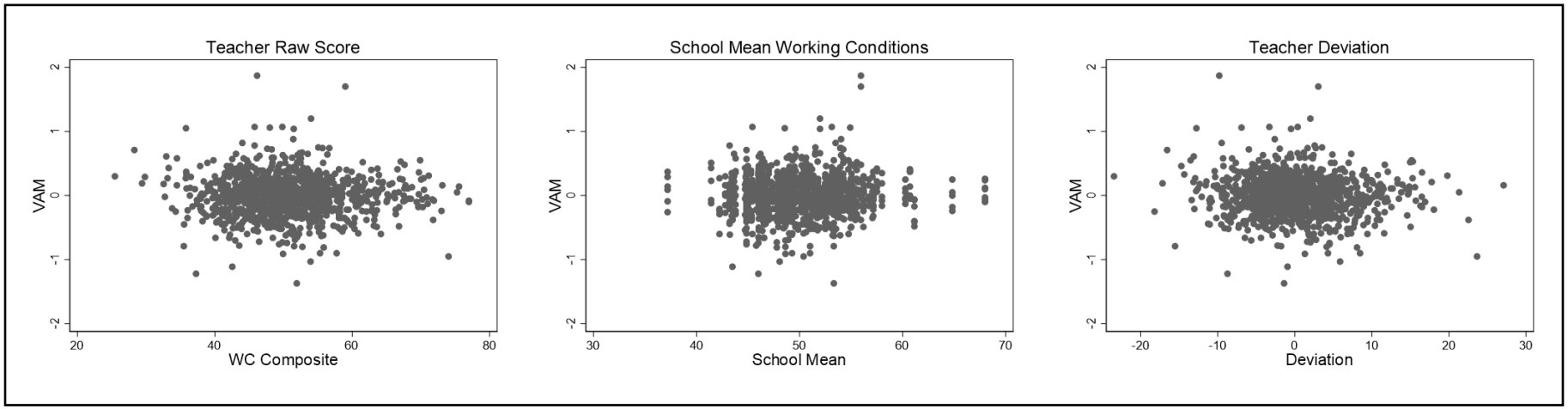

*Table 17. Regression coefficients for VAM scores and working conditions, with control variables, in odds ratios*

| | *Model 1* | | *Model 2* | | *Model 3* | | *Model 4* | |
|---|---|---|---|---|---|---|---|---|
| Teacher Raw Score (Sch mean + deviation) | **0.94*** ** | **(0.01)** | | | | | | |
| School Mean | | | **0.91*** ** | **(0.02)** | | | **0.90*** ** | **(0.02)** |
| Teacher Deviation | | | | | **0.95*** ** | **(0.01)** | **0.95*** ** | **(0.01)** |
| Teacher VAM Score | 1.21 | (0.29) | 1.31 | (0.32) | 1.20 | (0.29) | 1.25 | (0.30) |
| Male | 0.96 | (0.20) | 0.92 | (0.19) | 0.95 | (0.20) | 0.95 | (0.20) |
| Black | **0.71*** | **(0.14)** | **0.64**** | **(0.13)** | **0.69*** | **(0.14)** | **0.70*** | **(0.14)** |
| Hispanic | 0.81 | (0.28) | 0.75 | (0.26) | 0.79 | (0.28) | 0.80 | (0.28) |
| Other Race | 0.75 | (0.44) | 0.67 | (0.39) | 0.71 | (0.42) | 0.73 | (0.43) |
| New Teacher | **1.62*** ** | **(0.30)** | **1.64*** ** | **(0.30)** | **1.62**** | **(0.30)** | **1.64*** ** | **(0.30)** |
| Middle/High School | 0.78 | (0.20) | 0.76 | (0.20) | 0.90 | (0.24) | 0.73 | (0.19) |
| ELA Teacher | 1.00 | (0.31) | 0.99 | (0.30) | 0.99 | (0.32) | 1.00 | (0.31) |
| Math Teacher | 0.71 | (0.23) | 0.68 | (0.21) | 0.69 | (0.23) | 0.71 | (0.23) |
| Sch. Predominantly Minority | 1.51 | (0.39) | 1.37 | (0.35) | **1.81**** | **(0.49)** | 1.35 | (0.35) |
| Sch Prior Achievement ELA | 0.92 | (0.25) | 0.99 | (0.27) | 0.78 | (0.22) | 1.02 | (0.28) |
| Intercept | **0.32*** ** | **(0.10)** | **0.38*** ** | **(0.11)** | **0.26*** ** | **(0.08)** | **0.36*** ** | **(0.11)** |
| Tao 00 | 0.19 | (0.13) | 0.16 | (0.12) | 0.29 | (0.14) | 0.17 | (0.12) |
| Parameters | 19 | | 19 | | 19 | | 20 | |
| log likelihood | -603.50 | | -608.76 | | -610.26 | | -601.71 | |
| -2*log likelihood | 1206.99 | | 1217.53 | | 1220.52 | | 1203.42 | |
| AIC | 1244.99 | | 1255.53 | | 1258.52 | | 1243.42 | |
| ICC | 0.05 | | 0.05 | | 0.08 | | 0.05 | |

*p<.1, **p<.05, ***p<.001

*Table 18. Regression coefficients for interaction between VAM scores and working conditions, in odds ratios*

| | *Model 1* | | *Model 2* | |
|---|---|---|---|---|
| School Mean | **0.90*** ** | **(0.02)** | **0.91*** ** | **(0.02)** |
| Teacher Deviation | **0.95*** ** | **(0.01)** | **0.95*** ** | **(0.01)** |
| Teacher VAM Score | 1.15 | (0.28) | 1.23 | (0.30) |
| VAM*School Mean WC | 0.96 | (0.06) | 0.98 | (0.06) |
| Male | | | 0.95 | (0.20) |
| Black | | | **0.70*** | **(0.14)** |
| Hispanic | | | 0.80 | (0.28) |
| Other Race | | | 0.73 | (0.43) |
| New Teacher | | | **1.64*** ** | **(0.30)** |
| Middle/High School | | | 0.73 | (0.19) |
| ELA Teacher | | | 1.01 | (0.31) |
| Math Teacher | | | 0.72 | (0.23) |
| Sch. Predominantly Minority | | | 1.36 | (0.36) |
| Sch Prior Achievement ELA | | | 1.01 | (0.28) |
| Intercept | **0.31*** ** | **(0.04)** | **0.36*** ** | **(0.11)** |
| Tao 00 | 0.21 | (0.13) | 0.17 | (0.12) |
| Parameters | 11 | | 21 | |
| log likelihood | -613.10 | | -601.66 | |
| -2*log likelihood | 1226.20 | | 1203.31 | |
| AIC | 1248.20 | | 1245.31 | |
| ICC | 0.06 | | 0.05 | |

*p<.1, **p<.05, ***p<.001

APPENDIX B – SUPPLEMENTARY TABLES

*Table 19. Correlation coefficients of teacher characteristics and school mean working conditions at the teacher level*

| | *Turnover* | *Male* | *White* | *Black* | *Hispanic* | *Other Race* | *New Teacher* | *Middle/ High School* | *Generalist* | *Math* | *ELA* |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Working Conditions School Mean | -0.15 | -0.08 | 0.12 | -0.12 | 0.01 | -0.04 | -0.07 | -0.28 | 0.10 | -0.03 | -0.06 |
| Time | -0.14 | 0.01 | 0.06 | -0.08 | 0.03 | 0.01 | -0.03 | -0.04 | -0.07 | 0.03 | 0.03 |
| Resources | -0.13 | -0.06 | 0.14 | -0.15 | 0.02 | -0.03 | -0.04 | -0.18 | 0.06 | -0.01 | -0.04 |
| Community Support | -0.11 | -0.10 | 0.20 | -0.21 | 0.00 | -0.02 | -0.12 | -0.26 | 0.03 | 0.00 | -0.03 |
| Student Conduct | -0.14 | -0.10 | 0.15 | -0.16 | 0.01 | -0.05 | -0.07 | -0.37 | 0.12 | -0.04 | -0.06 |
| Teacher Leadership | -0.12 | -0.05 | 0.08 | -0.08 | 0.03 | -0.03 | -0.04 | -0.25 | 0.08 | 0.00 | -0.07 |
| School Leadership | -0.13 | -0.09 | 0.09 | -0.09 | 0.02 | -0.04 | -0.06 | -0.30 | 0.14 | -0.04 | -0.08 |
| Professional Development | -0.09 | -0.08 | 0.01 | 0.00 | 0.00 | -0.05 | -0.05 | -0.30 | 0.23 | -0.10 | -0.10 |
| Instructional Practice and Support | -0.13 | -0.07 | -0.02 | 0.05 | -0.03 | -0.04 | -0.05 | -0.14 | 0.13 | -0.05 | -0.07 |

*Table 19 (cont). Correlation coefficients of teacher characteristics and school mean working conditions at the teacher level*

| | *VAM* | *Predominantly Minority* | *Prior Achievement* | *WC Composite Raw Score* | *Time* | *Resources* | *Community Support* | *Student Conduct* | *Teacher Leadership* | *School Leadership* | *Professional Development* | *Instructional Practice and Support* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Working Conditions School Mean Score | 0.04 | -0.47 | 0.46 | 1.00 | | | | | | | | |
| Time | 0.03 | -0.29 | 0.24 | 0.76 | 1.00 | | | | | | | |
| Resources | 0.02 | -0.38 | 0.37 | 0.82 | 0.62 | 1.00 | | | | | | |
| Community Support | 0.01 | -0.60 | 0.64 | 0.83 | 0.48 | 0.61 | 1.00 | | | | | |
| Student Conduct | 0.06 | -0.42 | 0.46 | 0.89 | 0.60 | 0.65 | 0.79 | 1.00 | | | | |
| Teacher Leadership | 0.05 | -0.35 | 0.33 | 0.90 | 0.67 | 0.67 | 0.67 | 0.78 | 1.00 | | | |
| School Leadership | 0.05 | -0.39 | 0.37 | 0.95 | 0.70 | 0.72 | 0.73 | 0.85 | 0.89 | 1.00 | | |
| Professional Development | 0.01 | -0.31 | 0.22 | 0.84 | 0.59 | 0.70 | 0.57 | 0.62 | 0.77 | 0.78 | 1.00 | |
| Instructional Practice and Support | 0.03 | -0.37 | 0.27 | 0.79 | 0.56 | 0.56 | 0.57 | 0.61 | 0.68 | 0.74 | 0.72 | 1.00 |

*Table 20. Correlation coefficients of teacher characteristics and teacher deviation scores*

| | *Turnover* | *Male* | *White* | *Black* | *Hispanic* | *Other Race* | *New Teacher* | *Middle/ High School* | *Generalist* | *Math* | *ELA* |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Working Conditions School Mean | -0.12 | 0.07 | -0.14 | 0.12 | 0.03 | 0.03 | -0.03 | -0.01 | 0.00 | 0.05 | -0.05 |
| Time | -0.12 | 0.05 | -0.10 | 0.09 | 0.02 | 0.02 | -0.04 | 0.00 | -0.01 | 0.07 | -0.06 |
| Resources | -0.11 | 0.10 | -0.10 | 0.08 | 0.04 | 0.02 | 0.00 | -0.01 | 0.00 | 0.05 | -0.05 |
| Community Support | -0.07 | 0.02 | -0.12 | 0.12 | 0.03 | 0.00 | -0.04 | -0.01 | 0.00 | 0.01 | -0.02 |
| Student Conduct | -0.10 | 0.07 | -0.11 | 0.10 | 0.03 | 0.03 | -0.03 | 0.00 | 0.00 | 0.02 | -0.01 |
| Teacher Leadership | -0.09 | 0.08 | -0.09 | 0.07 | 0.03 | 0.02 | 0.01 | -0.01 | 0.00 | 0.06 | -0.06 |
| School Leadership | -0.13 | 0.07 | -0.12 | 0.09 | 0.04 | 0.05 | -0.01 | -0.01 | 0.00 | 0.04 | -0.04 |
| Professional Development | -0.08 | 0.03 | -0.09 | 0.08 | 0.01 | 0.03 | 0.01 | -0.01 | 0.01 | 0.03 | -0.04 |
| Instructional Practice and Support | -0.03 | 0.02 | -0.11 | 0.10 | 0.02 | 0.02 | -0.04 | -0.01 | 0.00 | 0.01 | -0.02 |

*Table 20 (cont.). Correlation coefficients of teacher characteristics and teacher deviation scores*

| | *VAM* | *Predominantly Minority(* | *Prior Achievement* | *WC Composite Raw Score* | *Time* | *Resources* | *Community Support* | *Student Conduct* | *Teacher Leadership* | *School Leadership* | *Professional Development* | *Instructional Practice and Support* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Working Conditions Raw Score | -0.07 | 0.01 | -0.01 | 1.00 | | | | | | | | |
| Time | -0.08 | 0.01 | -0.01 | 0.71 | 1.00 | | | | | | | |
| Resources | -0.03 | 0.00 | 0.00 | 0.74 | 0.52 | 1.00 | | | | | | |
| Community Support | -0.05 | 0.01 | 0.00 | 0.67 | 0.35 | 0.41 | 1.00 | | | | | |
| Student Conduct | -0.05 | 0.00 | -0.01 | 0.75 | 0.46 | 0.50 | 0.53 | 1.00 | | | | |
| Teacher Leadership | -0.09 | 0.00 | 0.00 | 0.82 | 0.51 | 0.55 | 0.49 | 0.57 | 1.00 | | | |
| School Leadership | -0.05 | 0.00 | 0.00 | 0.87 | 0.54 | 0.58 | 0.52 | 0.61 | 0.73 | 1.00 | | |
| Professional Development | -0.05 | 0.00 | 0.00 | 0.79 | 0.46 | 0.49 | 0.44 | 0.49 | 0.60 | 0.70 | 1.00 | |
| Instructional Practice and Support | -0.03 | 0.01 | -0.01 | 0.79 | 0.51 | 0.48 | 0.43 | 0.48 | 0.58 | 0.67 | 0.64 | 1.00 |

*Table 21. Baseline regression model coefficients, with continuous race variables, in odds ratios*

| | *Model 1* | | *Model 2* | | *Model 3* | | *Model 4* | | *Model 5* | | *Model 6* | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Male | | | 0.94 | (0.19) | | | | | | | 0.91 | (0.19) |
| Black | | | **0.69*** | **(0.14)** | | | | | | | **0.60**** | **(0.13)** |
| Hispanic | | | 0.74 | (0.26) | | | | | | | 0.74 | (0.25) |
| Other Race | | | 0.67 | (0.40) | | | | | | | 0.66 | (0.39) |
| New Teacher | | | **1.73***** | **(0.31)** | | | | | | | **1.63***** | **(0.30)** |
| Middle/High School | | | 0.96 | (0.26) | | | | | | | 0.89 | (0.23) |
| ELA Teacher | | | 0.88 | (0.28) | | | | | | | 1.05 | (0.34) |
| Math Teacher | | | 0.59 | (0.20) | | | | | | | 0.71 | (0.24) |
| Sch. Pct. Black | | | | | **1.01**** | **(0.00)** | | | 1.00 | (0.01) | 1.01 | (0.01) |
| Sch. Pct. Hispanic | | | | | 1.01 | (0.01) | | | 1.01 | (0.01) | 1.00 | (0.01) |
| Sch Prior Achievement | | | | | | | **0.59**** | **(0.14)** | 0.72 | (0.28) | 0.72 | (0.28) |
| Intercept | **0.28***** | **(0.04)** | **0.38***** | **(0.10)** | **0.18***** | **(0.05)** | **0.31***** | **(0.05)** | **0.24***** | **(0.10)** | **0.30**** | **(0.15)** |
| Tao 00 | 0.34 | (0.15) | 0.34 | (0.15) | 0.31 | (0.14) | 0.30 | (0.14) | 0.30 | (0.14) | 0.28 | (0.14) |
| Parameters | 7 | | 15 | | 9 | | 8 | | 10 | | 18 | |
| log likelihood | -633.48 | | -622.62 | | -630.90 | | -630.82 | | -630.55 | | -619.46 | |
| -2*log likelihood | 1266.96 | | 1245.24 | | 1261.8 | | 1261.65 | | 1261.1 | | 1238.92 | |
| AIC | 1280.96 | | 1275.24 | | 1279.8 | | 1277.65 | | 1281.1 | | 1274.92 | |
| ICC | 0.09 | | 0.09 | | 0.09 | | 0.08 | | 0.08 | | 0.08 | |

*p<.1, **p<.05, ***p<.001

*Table 22. Regression model coefficients for working conditions composite variables, with continuous race variables, in odds ratios*

| | *Model 1* | | *Model 2* | | *Model 3* | | *Model 4* | |
|---|---|---|---|---|---|---|---|---|
| Teacher Raw Score (Sch mean + deviation) | **0.94*** ** | **(0.01)** | | | | | | |
| School Mean | | | **0.90*** ** | **(0.02)** | | | **0.90*** ** | (0.02) |
| Teacher Deviation | | | | | **0.95*** ** | **(0.01)** | **0.95*** ** | (0.01) |
| Male | 0.95 | (0.20) | 0.91 | (0.19) | 0.95 | (0.20) | 0.94 | (0.19) |
| Black | **0.69*** | **(0.15)** | **0.62*** | **(0.13)** | **0.67*** | **(0.14)** | **0.69*** | **(0.14)** |
| Hispanic | 0.80 | (0.28) | 0.75 | (0.26) | 0.78 | (0.27) | 0.79 | (0.28) |
| Other Race | 0.77 | (0.45) | 0.67 | (0.40) | 0.73 | (0.44) | 0.75 | (0.44) |
| New Teacher | **1.63*** ** | **(0.30)** | **1.64*** ** | **(0.30)** | **1.62*** ** | **(0.30)** | **1.64*** ** | **(0.30)** |
| Middle/High School | 0.75 | (0.19) | 0.73 | (0.19) | 0.85 | (0.23) | 0.70 | (0.18) |
| ELA Teacher | 1.04 | (0.33) | 1.03 | (0.32) | 1.05 | (0.34) | 1.03 | (0.32) |
| Math Teacher | 0.75 | (0.24) | 0.71 | (0.22) | 0.74 | (0.25) | 0.74 | (0.24) |
| Sch. Pct. Black | 1.00 | (0.01) | 1.00 | (0.01) | 1.01 | (0.01) | 1.00 | (0.01) |
| Sch. Pct. Hispanic | 1.00 | (0.01) | 1.00 | (0.01) | 1.00 | (0.01) | 1.00 | (0.01) |
| Sch Prior Achievement | 0.85 | (0.32) | 0.95 | (0.35) | 0.71 | (0.28) | 0.95 | (0.36) |
| Intercept | **0.37** ** | **(0.17)** | **0.43*** | **(0.20)** | **0.29** ** | **(0.15)** | **0.43*** | (0.20) |
| Tao 00 | 0.19 | (0.13) | 0.15 | (0.12) | 0.31 | (0.15) | 0.17 | (0.13) |
| Parameters | 19 | | 19 | | 19 | | 20 | |
| log likelihood | -604.90 | | -609.90 | | -612.62 | | -602.65 | |
| -2*log likelihood | 1209.79394 | | 1219.8 | | 1225.24 | | 1205.31 | |
| AIC | 1247.79394 | | 1257.8 | | 1263.24 | | 1245.31 | |
| ICC | 0.05 | | 0.04 | | 0.08 | | 0.05 | |

*p<.1, **p<.05, ***p<.001

*Table 23. Regression model coefficients for VAM score models, with continuous race variables, in odds ratios*

| | *Model 1* | | *Model 2* | | *Model 3* | |
|---|---|---|---|---|---|---|
| School Mean | | | **0.90*** ** | **(0.02)** | **0.90*** ** | **(0.02)** |
| Teacher Deviation | | | **0.95*** ** | **(0.01)** | **0.95*** ** | **(0.01)** |
| Teacher VAM Score | 1.27 | (0.30) | 1.25 | (0.30) | 1.23 | (0.30) |
| VAM*School Mean WC | | | | | 0.98 | (0.06) |
| Male | 0.92 | (0.19) | 0.95 | (0.20) | 0.95 | (0.20) |
| Black | **0.60**** | **(0.13)** | **0.68*** | **(0.14)** | **0.68*** | **(0.14)** |
| Hispanic | 0.74 | (0.26) | 0.80 | (0.28) | 0.80 | (0.28) |
| Other Race | 0.67 | (0.40) | 0.76 | (0.44) | 0.76 | (0.44) |
| New Teacher | **1.64*** ** | **(0.30)** | **1.66*** ** | **(0.30)** | **1.65*** ** | **(0.30)** |
| Middle/High School | 0.88 | (0.23) | 0.70 | (0.18) | 0.70 | (0.18) |
| ELA Teacher | 1.05 | (0.34) | 1.03 | (0.32) | 1.04 | (0.32) |
| Math Teacher | 0.71 | (0.24) | 0.74 | (0.24) | 0.74 | (0.24) |
| Sch. Pct. Black | 1.01 | (0.01) | 1.00 | (0.01) | 1.00 | (0.01) |
| Sch. Pct. Hispanic | 1.00 | (0.01) | 1.00 | (0.01) | 1.00 | (0.01) |
| Sch Prior Achievement ELA | 0.72 | (0.28) | 0.96 | (0.36) | 0.96 | (0.36) |
| Intercept | **0.30**** | **(0.15)** | **0.42*** | **(0.20)** | **0.42*** | **(0.20)** |
| Tao 00 | 0.28 | (0.14) | 0.17 | (0.13) | 0.17 | (0.13) |
| Parameters | 19 | | 21 | | 22 | |
| log likelihood | -618.98 | | -602.23 | | -602.18 | |
| -2*log likelihood | 1237.95392 | | 1204.46256 | | 1204.35036 | |
| AIC | 1275.95392 | | 1246.46256 | | 1248.35036 | |
| ICC | 0.08 | | 0.05 | | 0.05 | |

*p<.1, **p<.05, ***p<.001

References

Akaike, H. (1973) Information theory and an extension of the maximum likelihood principle. In *Procedings of the Second International Symposium on Information Theory*, B.N. Petrov and F. Csaki (eds), 267-281. Akademia Kiado, Budapest.

Allensworth, E., Ponisciak, S., Mazzeo, C., & Consortium on Chicago School Research. (2009). *The Schools Teachers Leave: Teacher Mobility in Chicago Public Schools*. Consortium on Chicago School Research. Chicago, IL.

Alliance for Excellent Education (2014) *On the path to equity: Improving the effectiveness of beginning teachers*. Washington, DC. Retrieved from: http://all4ed.org/wp-content/uploads/2014/07/PathToEquity.pdf

American Education Research Association (2015). *AERA Statement on the Use of Value-Added Models (VAM) for the Evaluation of Educators and Educator Preparation Programs*, retrieved from: http://www.aera.net/Newsroom/News-Releases-and-Statements/AERA-Issues-Statement-on-the-Use-of-Value-Added-Models-in-Evaluation-of-Educators-and-Educator-Preparation-Programs

Au, W. (Interviewer) & Ladson-Bilings, G (Interviewee). (2005) Teacher Quality: Conversations on Quality [Interview Transcript] Retrieved from https://www.rethinkingschools.org/special_reports/quality_teachers/glor202.shtml

Benjamini, Y., and Y. Hochberg. 1995. Controlling the false discovery rate: a practical and powerful approach to multiple testing. *Journal of the Royal Statistical Society* B 57: 289-300.

Bill and Melinda Gates Foundation, (2012). Gathering Feedback for Teaching. Retrieved from http://k12education.gatesfoundation.org/download/?Num=2530&filename=MET_Gathering_Feedback_for_Teaching_Summary1.pdf

Borman, G. D., & Dowling, N. M. (2008). Teacher Attrition and Retention: A Meta-Analytic and Narrative Review of the Research. *Review of Educational Research*, 78(3), 367–409.

Boyd, D., Grossman, P., Ing, M., Lankford, H., Loeb, S., & Wyckoff, J. (2011). The Influence of School Administrators on Teacher Retention Decisions. *American Educational Research Journal*, 48(2), 303–333.

Boyd, D., Grossman, P., Lankford, H., Loeb, S., & Wyckoff, J. (2008). *Who leaves? Teacher attrition and student achievement*. National Bureau of Economic Research. Cambridge, MA. Retrieved from http://www.nber.org/papers/w14022

Boyd, D., Lankford, H., Loeb, S., & Wyckoff, J. (2005). Explaining the Short Careers of High-Achieving Teachers in Schools with Low-Performing Students. *The American Economic Review*, 95(2), 166–171.

Bryk, A. S., Sebring, P. B., Allensworth, E., Luppescu, S., & Easton, J. Q. (2010). *Organizing Schools for Improvement: Lessons from Chicago*. University of Chicago Press, IL.

Clotfelter, C., Glennie, E., Ladd, H., & Vigdor, J. (2008). Would higher salaries keep teachers in high-poverty schools? Evidence from a policy intervention in North Carolina. *Journal of Public Economics*, 92(5), 1352–1370.

Clotfelter, C., Ladd, H. F., Vigdor, J., & Wheeler, J. (2006). High-poverty schools and the distribution of teachers and principals. *North Carolina Law Review*. (85), 1345 - 1379.

Cohen, D. K., Raudenbush, S. W., & Ball, D. L. (2003). Resources, Instruction, and Research. *Educational Evaluation and Policy Analysis*, *25*(2), 119–142.

Coleman, J. et al (1966) *Equality of Educational Opportunity*. U.S. Department of Health, Education and Welfare. Washington, DC

Danielson, C. (2013). *The framework for teaching: Evaluation instrument*. Danielson Group Princeton, NJ.

Darling-Hammond, L. (2010). *The flat world and education: how America's commitment to equity will determine our future*. New York: Teachers College Press.

Djonko-Moore, C. M. (2015). An exploration of teacher attrition and mobility in high poverty racially segregated schools. *Race Ethnicity and Education*, 19(5), 1063-1087.

Elfers, A., Plecki, M., and Knapp, M. (2006) Teacher mobility: Looking more closely at "the movers" within a state system. *Peabody Journal of Education*, *81*(3), 94–127.

Ferguson, R. F., & Hirsch, E. (2014). How working conditions predict teaching quality and student outcomes. *Designing Teacher Evaluation Systems*, 332–380.

Frankenberg, E., Lee, C., & Orfield, G. (2003) A multiracial society with segregated schools: Are we losing the dream? Cambridge, MA: The Civil Rights Project, Harvard University.

Gamoran, A., Secada, W. G., & Marrett, C. B. (2000). The organizational context of teaching and learning. In *Handbook of the sociology of education* (pp. 37–63). Springer. New York, NY. Retrieved from http://link.springer.com/chapter/10.1007/0-387-36424-2_3

Goe, L. (2007). *The Link between Teacher Quality and Student Outcomes: A Research Synthesis.* National Comprehensive Center for Teacher Quality. Washington, DV Retrieved from http://eric.ed.gov/?id=ED521219

Goldhaber, D., Gross, B., Player, D., & Urban Institute (2007). *Are Public Schools Really Losing Their Best? Assessing the Career Transitions of Teachers and Their Implications for the*

*Quality of the Teacher Workforce. Working Paper 12*. National Center for Analysis of Longitudinal Data in Education Research. Washington, DC.

Goldring, R. (2014). *Teacher Attrition and Mobility: Results from the 2012-13 Teacher Follow-Up Survey. First Look. NCES 2014-077*. National Center for Education Statistics. Washington, DC. Retrieved from https://eric.ed.gov/?id=ED546773

Grissom, J. A. (2011). Can Good Principals Keep Teachers in Disadvantaged Schools? Linking Principal Effectiveness to Teacher Satisfaction and Turnover in Hard-to-Staff Environments. *Teachers College Record*, 113(11), 2552–2585.

Guarino, C. M., Santibanez, L., & Daley, G. A. (2006). Teacher Recruitment and Retention: A Review of the Recent Empirical Literature. *Review of Educational Research*, 76(2), 173–208.

Hanushek, E. (2002). Teacher quality. In L.T. Izumi & W.M Evers (Eds.), Teacher Quality (1-12) Stanford, Ca: Hoover Press.

Hanushek, E. A., Kain, J. F., O'Brien, D. M., & Rivkin, S. G. (2005). *The market for teacher quality*. National Bureau of Economic Research. Washington, DC. Retrieved from http://www.nber.org/papers/w11154

Hanushek, E. A., Kain, J. F., & Rivkin, S. G. (2004). Why Public Schools Lose Teachers. *Journal of Human Resources*, 39(2), 326–354.

Harris, D. N. (2011). *Value-Added Measures in Education: What Every Educator Needs to Know.* Cambridge, Mass: Harvard Education Press. Retrieved from http://eric.ed.gov/?id=ED515309

Harris, D. N., & Rutledge, S. A. (2010). Models and Predictors of Teacher Effectiveness: A Comparison of Research about Teaching and Other Occupations. *Teachers College Record*, 112(3), 914–960.

Hochschild, A. R. (2003). *The managed heart: Commercialization of human feeling*. Berkeley, CA: University of California Press.

Hughes, G. (2012). Teacher retention: Teacher characteristics, school characteristics, organizational characteristics, and teacher efficacy. *The Journal of Educational Research,* 105(4), 245-255 DOI: 10.1080/00220671.2011.584922

Ingersoll, R. M. (2001). Teacher turnover and teacher shortages: An organizational analysis. *American Educational Research Journal*, 38(3), 499–534.

Ingersoll, R. M. (2003). *Who controls teachers' work? Power and accountability in America's schools*. Cambridge, Mass: Harvard University Press.

Ingersoll, R. M., & Smith, T. M. (2004). Do teacher induction and mentoring matter? *NASSP Bulletin*, 88(638), 28–40.

Ingersoll, R., Merrill, L., & Stuckey, D. (2014). *Seven trends: The transformation of the teaching force*. Consortium for Policy Research in Education. Philadelphia, PA Retrieved from http://repository.upenn.edu/cpre_researchreports/79/

Jacob, A., Vidyarthi, E., Carroll, K., & Tntp. (2012). *The Irreplaceables: Understanding the Real Retention Crisis in America's Urban Schools*. The New Teachers Project. New York, NY.

Jennings, P. A., & Greenberg, M. T. (2009). The prosocial classroom: Teacher social and emotional competence in relation to student and classroom outcomes. *Review of Educational Research*, *79*(1), 491–525.

Johnson, S. M., Berg, J. & H., Donaldson (2005). *Who stays in teaching and why?: A review of the literature on teacher retention*. Project on the Next Generation of Teachers, Harvard Graduate School of Education. Cambridge, MA.

Johnson, S. M., & Birkeland, S. E. (2003). Pursuing a "Sense of Success": New Teachers Explain Their Career Decisions. *American Educational Research Journal*, 40(3), 581–617.

Johnson, S. M., Kraft, M. A., & Papay, J. P. (2012). How Context Matters in High-Need Schools: The Effects of Teachers' Working Conditions on Their Professional Satisfaction and Their Students' Achievement. *Teachers College Record*, 114(10).

Kalleberg, A. L. (2007). *The mismatched worker*. New York, NY : W.W. Norton & Company.

Kirst, M. (1984) *Who controls our schools?* New York, NY: W.H. Freeman and Co.

Kraft, M. A., Marinell, W. H., & Yee, D. S.-W. (2016). School organizational contexts, teacher turnover, and student achievement: Evidence from panel data. *American Educational Research Journal*, 53(5), 1411–1449. https://doi.org/10.3102/0002831216667478

Krieg, J. M. (2006). Teacher quality and attrition. *Economics of Education Review*, 25(1), 13–27.

Kukla-Acevedo, S. (2009). Leavers, movers, and stayers: The role of working conditions in teacher mobility decisions. *The Journal of Educational Research*, 102(6), 443–452.

Ladd, H. F. (2011). Teachers' Perceptions of Their Working Conditions: How Predictive of Planned and Actual Teacher Movement? *Educational Evaluation and Policy Analysis*, 33(2), 235–261.

Lankford, H., Loeb, S., & Wyckoff, J. (2002). Teacher sorting and the plight of urban schools: A descriptive analysis. *Educational Evaluation and Policy Analysis*, 24(1), 37–62.

Lortie, D. C. (2002). *Schoolteacher: A Sociological Study* (2nd edition). Chicago, IL.: The University of Chicago Press.

Marinell, W. H., & Coca, V. M. (2013). Who stays and who leaves? Findings from a three-part study of teacher turnover in NYC middle schools. New York, NY: The Research Alliance for New York City Schools. Retrieved from http://eric.ed.gov/?id=ED540818

Morgan, S. & Daniel T. S. 2016. "School and Teacher Effects." Working Paper, School of Education, Johns Hopkins University. (Invited for 2017 publication in Barbara Schneider, ed., Handbook of the Sociology of Education in the 21st Century, Springer.)

National Center for Education Statistics (2015) *Public and private elementary and secondary teachers, enrollment, pupil/teacher ratios, and new teacher hires: Selected years, fall 1955 through 2025*. Washington, DC: NCES. Retrieved from: http://nces.ed.gov/programs/digest/d15/tables/dt15_208.20.asp?current=yes

National Commission on Teaching and Americas Future (2007) *The High Cost of Teacher Turnover*. Washington, DC: NCTAF. Retrieved from http://nctaf.org/wp-content/uploads/2012/01/NCTAF-Cost-of-Teacher-Turnover-2007-policy-brief.pdf

OECD (2008). *Measuring Improvements in Learning Outcomes: Best Practices to Assess the Value-Added of Schools*. Paris: OECD Publishing.

Pogodinski, B., Youngs, P., Frank, K., & Belman, D. (2012) Administrative climate and novices' intent to remain teaching. *The Elementary School Journal*, 113(2), 253-275.

Raudenbush, S. W., & Bryk, A. S. (2002). *Hierarchical Linear Models: Applications and Data Analysis Methods* (2nd edition). Thousand Oaks, CA: SAGE Publications, Inc.

Redding, C., & Smith, T. M. (2016). Easy in, Easy out Are Alternatively Certified Teachers Turning Over at Increased Rates? *American Educational Research Journal*, 0002831216653206.

Rice, J. K. (2003). Teacher quality: Understanding the effectiveness of teacher attributes. Washington, DC: Economic Policy Institute. Retrieved from http://eric.ed.gov/?id=ED480858

Rivkin, S. G., Hanushek, E. A., & Kain, J. F. (2005). Teachers, schools, and academic achievement. *Econometrica*, 417–458.

Rockoff, J. E. (2004). The Impact of Individual Teachers on Student Achievement: Evidence from Panel Data. *The American Economic Review*, *94*(2), 247–252.

Ronfeldt, M., Loeb, S., & Wyckoff, J. (2013). How Teacher Turnover Harms Student Achievement. *American Educational Research Journal*, 50(1), 4–36. https://doi.org/10.3102/0002831212463813

Scafidi, B., Sjoquist, D. L., & Stinebrickner, T. R. (2007). Race, Poverty, and Teacher Mobility. *Economics of Education Review*, 26(2), 145–159.

Simon, N. S., & Johnson, S. M. (2015). Teacher turnover in high-poverty schools: What we know and can do. *Teachers College Record*, 117, 1–36.

Smith, T. M., & Ingersoll, R. M. (2004). What are the effects of induction and mentoring on beginning teacher turnover? *American Educational Research Journal*, 41(3), 681–714.

Strunk, K. & Robinson, J. (2006). Oh, won't you stay: A multilevel analysis of the difficulties in retaining qualified teachers, *Peabody Journal of Education*, 81:4, 65-94, DOI: 10.1207/s15327930pje8104_4

Stuit, D. A., & Smith, T. M. (2012). Explaining the gap in charter and traditional public school teacher turnover rates. *Economics of Education Review*, 31(2), 268–279.

Torres, C. (2016). Is this work sustainable? Teacher turnover and perceptions of workload in charter management organizations. *Urban Education*, 51 (8), 891-914.

Tyack, D. B. (1974). *The one best system: a history of American urban education*. Cambridge, Mass: Harvard University Press.

Wayne, A. J., & Youngs, P. (2003). Teacher characteristics and student achievement gains: A review. *Review of Educational Research*, 73(1), 89–122.

Weick, K. E. (1976). Educational organizations as loosely coupled systems. *Administrative Science Quarterly*, 1–19.

Weiss, E. (1999) Perceived working conditions and first-year teachers' morale, career choice commitment, and planned retention: a secondary analysis. *Teaching and Teacher Education*, 15, 861-879.

White, M., Rowan, B., Alter, G., Greene, C. (2014) User Guide to Measures of Effective Teaching Longitudinal Database. University of Michigan: Inter-University Consortium for Political and Social Research, retrieved from https://www.icpsr.umich.edu/icpsrweb/METLDB/holdings/documentation

Willms, J. (1986) Social class segregation and its relationship to pupils' examination results in Scotland. *American Sociological Review*, 51(2), 224-241.

Wilson, S. M., & Floden, R. E. (2003). *Creating effective teachers: Concise answers for hard questions. An addendum to the report*. New York, NY: AACTE Publications. Retrieved from http://eric.ed.gov/?id=ED476366

Yesil Dagli, U. (2012). America's Public School Kindergarten Teachers' Job Turnover and Associated Factors. *Educational Sciences: Theory and Practice*, Special Issue, Autumn, 3121-3134.

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**School of Education, Johns Hopkins University,** Baltimore, MD Fall 2013-Present
Doctoral Student and Research Intern

- Relevant coursework: Quantitative Research Methods; Applied Multiple Regression Analysis; Spatial Analysis and GIS; Categorical Data Analysis; Causal Inference; Foundations of Ed. Sci. Research; Controversies in Measurement for Ed. Sci.; Analysis of Longitudinal Data; Hierarchical Linear Models

**Levy Ratner, PC,** New York City, NY Winter 2017-Present
Statistical Analyst Consultant

- Conducted survival analysis and regression analysis using a large dataset from a municipal government agency
- Developed and implemented research plan, including formulation of research questions and analytic strategies
- Produced reports and memos to convey findings to audiences of different statistical backgrounds

**Center for Social Organization of Schools, Johns Hopkins University,** Baltimore, MD
Spring 2012-Winter 2014
Research Assistant

- Oversaw the quantitative components of ongoing education research projects investigating the impact of education reform programs
- Conducted data analysis using advanced statistical techniques and managed a national database
- Produced quarterly reports on academic early warning indicators
- Designed and conducted surveys and focus groups on in-field data report use
- Led web-based staff training sessions on data utilization
- Recruited, trained and supervised research interns

**Research for Action**, Philadelphia, PA Fall 2010-Spring 2011

Research Intern

- Conducted fieldwork and interviews and assisted in data collection and presentation
- Ran basic quantitative analyses on data
- Collected and summarized literature review materials

**Undergraduate Research Summer Institute, Vassar College**, Poughkeepsie, NY Summer 2005 & 2006
Research Assistant

- Assisted with the theoretical development of research and provided input on study design
- Oversaw participant recruitment and data collection
- Assisted in data coding, analysis and presentation

## TEACHING EXPERIENCE

**School of Education, Johns Hopkins University,** Baltimore, MD, Spring 2015
Teaching Assistant: Linear Models for the Social Sciences, Graduate Course

**Success Charter Network,** New York, NY Fall 2011
Chess Instructor

**Chess in the Schools,** New York, NY Fall 2007-Summer 2010
Chess Instructor

## Publications

Stein, M. & **Fonseca, E**. (2016). A review and analysis of evaluations of summer programs. In K. Alexander, S. Pitcock, & M. Boulay (Eds.), *Summer Learning and Summer Learning Loss: Theory, Research and Practice.* New York: Teachers College Press.

MacIver, M., Epstein, J., Sheldon, S., **Fonseca, E**. (2015) Engaging Families to Support Students' Transition to High School: Evidence from the Field. *High School Journal,* 99(1), pg. 27.

## Presentations

Rice, E. Jung, S.B., **Fonseca, E**. (2017) Exploring the discourse of local education finance. Paper presented at the Annual Meeting of the American Educational Research Association, San Antonio.

**Fonseca, E.**, Stein, M. (2016) *Charter Schools, Leadership, and Teacher Turnover: A Difference between Sectors?* Paper presented at the Annual Meeting of the American Educational Research Association, Washington DC.

MacIver, M., Epstein, J., Sheldon, S., **Fonseca, E**. (2015) *Engaging Families to Support Students' Transition to High School: Evidence from the Field*. Paper presented at the Annual Meeting of the American Educational Research Association, Chicago.

Tugade, M., **Fonseca, E**. (2006) *The Effects of Conscious and Nonconscious Positive Emotions on Sadness and Cognitive Flexibility*, Poster presented at the Society for Personality and Social Psychology Annual Conference